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DOCUMENTS

OF THE

ASSEMBLY

OF THE

STATE OF NEW YORK.

ONE HUNDRED AND THIRTY-SECOND SESSION.

1909.

VOL. XX.—No. 29.—PART 4.

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J. B. LYON COMPANY, STATE PRINTERS
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Horse Barn
Forcing Houses
Alfalfa Field
Vineyard
Orchard of Dwarf Apple Trees

The New York Agricultural Experiment Station is a State institution under the care of a Board of Control consisting of nine members, with the Governor of the State and the Commissioner of Agriculture as ex-officio members, the other seven being appointed by the Governor. The institution is supported almost wholly by annual State appropriations. Its work is carried on by a scientific staff, consisting of twenty-eight members, whose efforts are divided among seven departments — bacteriology, botany, chemistry, dairy husbandry, entomology, horticulture and poultry husbandry. The work undertaken consists chiefly of an investigation of agricultural problems, particularly those relating to soil fertility, crop production, the control of fungous insect pests, plant breeding, the management of fruit areas, the chemistry and bacteriology of milk and its products and the feeding and care of poultry. The results of the Station's investigations are published in bulletins that are sent free to all applicants.

STATE OF NEW YORK — DEPARTMENT OF AGRICULTURE

REPORT

OF

FARMERS' INSTITUTES

Comprising Addresses at the 10th Annual Normal
Institute held at the New York Agricultural
Experiment Station, Geneva, N. Y.,
December 1-5, 1908

BY

RAYMOND A. PEARSON, Commissioner of Agriculture

TRANSMITTED TO THE LEGISLATURE JANUARY 15, 1909

ALBANY
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1909

STATE OF NEW YORK

No. 29.

IN ASSEMBLY

JANUARY 15, 1909.

REPORT OF FARMERS' INSTITUTES

STATE OF NEW YORK

DEPARTMENT OF AGRICULTURE,
ALBANY, January 15, 1909.

To the Legislature of the State of New York:

I have the honor to submit herewith a report on Farmers' Institute Work, comprising the addresses at the Tenth Annual Normal Institute held at the New York Agricultural Experiment Station, Geneva, N. Y., December 1–5, 1908.

RAYMOND A. PEARSON,
Commissioner of Agriculture.

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INTRODUCTORY STATEMENT

Formerly farmers' institute work was reported annually by calendar years. Under the present administration the institute year has been changed to the fiscal year usual for State departments, beginning October 1st. *The report of a year hence will include all statistical matter and other information for the period from January 1, 1908 to September 30, 1909.* An incidental advantage of changing the twelve months to be reported upon is that the main part of the institute work, which is conducted in the winter, now falls within one report.

This volume contains most of the addresses which were delivered at the normal institute at the State Agricultural Experiment Station, December 1 to 5, 1908, as collected and arranged by Mr. D. P. Witter, Conductor.

The normal institute is regularly held before the opening of the winter institute season and alternates between the State College of Agriculture and State Experiment Station. Speakers at normal institutes are mainly those engaged in experimentation and most of the time of the sessions is filled with presentation and discussion of facts and theories deduced from recent experimental work. Developments of important phases of agriculture are also discussed. One valuable result of the normal institute is that the institute workers and the men on the staffs of the College and Experiment Station become better acquainted with one another and one another's problems; and a second valuable result is that such meetings lead to more uniform methods of work.

A few changes in the plan and conduct of farmers' institutes were inaugurated in the year 1908. These are explained in an address before the normal institute which is printed in full on pages 9 to 13.

RAYMOND A. PEARSON,
Commissioner of Agriculture.

Outline of Plan of Farmers' Institute Work

By R. A. Pearson

State Commissioner of Agriculture

Commissioner Pearson explained that he had been prevented from attending all the sessions of the Normal Institute because of other important engagements, including the outbreak of foot and mouth disease in western New York. The very contagious nature of this disease was explained and illustrations given showing the importance of stringent measures for its suppression. The institute lecturers were asked to have this new disease in mind as long as quarantine continued in different parts of the State so that they might answer questions pertaining to it.

As to the institutes Commissioner Pearson spoke as follows:

This is not a time for me to indulge in generalities. I am endeavoring to keep in close touch with the details of our institute work. Last summer a conference was held in Albany attended by the older conductors of institutes and other leaders in agricultural advancement, including Dean Bailey, of the State College of Agriculture, Director Jordan, of the State Experiment Station, and Mr. F. N. Godfrey, master of the State Grange. Institute problems were discussed at considerable length, policies were outlined, and the policies which were generally agreed upon at that conference have been and are now in operation. During the last few weeks when I have been obliged to be absent from Albany much of the time on account of the foot and mouth disease, we have been particularly fortunate in having the services of Messrs. Witter, Ward and Van Wagenen, to whom credit is largely due for arrangements for this meeting and arrangement of details for a large part of the coming institute season.

We are not making radical changes in our institute methods. We are making but few changes. We shall advertise our institutes more widely, hoping to get out larger numbers in attendance.

Correspondents of the institutes are being asked to send us names and addresses of about one hundred farmers who might be interested in each meeting, and we are sending to each of these farmers directly from Albany a program of their meeting together with a circular letter inviting their interest and cooperation. Newspaper advertising in the form of news items is also under way. Miss Dann, who was previously engaged as an institute reporter, is now located in the Albany office for the purpose of giving this advance notice work her particular attention. Correspondents send lists of newspapers that have the largest circulation in different communities, and news items and programs are sent to the appropriate papers. A list of the institutes in each assistant commissioner's district, of which there are ten in the State, has been sent to the assistant commissioners with request that they communicate with local correspondents and give such attention and assistance in the distribution of advertising matter as seems necessary. Thus we shall be more sure that posters and programs are well distributed in advance of the meetings. Furthermore, some of the railroads are now actively cooperating by giving special rates from towns within distances of thirty to forty miles of institutes. The Delaware and Hudson Company has entered into this cooperation, arranging for the one-fare rate. The matter is up with the New York Central, and they promise some concessions.

Recently a conference has been held in practically every county for the purpose of discussing the institute work and needs in the different counties. To each conference the masters of granges, presidents of agricultural societies and correspondents of institutes last year were invited to meet with a representative of the Department. Messrs. Ward and Witter have served as department representatives at most of these meetings. The institute work in the various counties was thoroughly discussed, places where meetings should be held and duration of meetings were agreed upon, within the limits of time assigned to the county, and the local leaders have often submitted valuable suggestions as to subjects and speakers. In making up our programs the recommendations of these conferences are followed as closely as possible.

A large number of one-day institutes are asked for. Probably the reason is that the representatives at the conferences wish to recognize the claims of as many towns as possible. Largely on account of these short institutes, schedules are planned so that a corps of workers, numbering five or six, will be conducting two institutes at the same time during a large part of the season. After the first of January, and to a certain extent prior to that date, there will be four principal corps of workers with a conductor in charge of each corps; and there will be an assistant conductor in each corps. A corps of workers will open a meeting, for example, on Monday morning. The assistant conductor and one or two other speakers will appear on this program and immediately proceed to the next point, leaving the first meeting for the chief conductor and other assistants to finish. The meeting at the second point will be opened before the first is closed. When the first meeting is finished, some of its speakers will proceed immediately to the third point, others going to the second place to help the assistant conductor, and a third meeting will be well under way before the second is closed, and so on. Thus practically two corps of workers are proceeding along a line of railroad, alternating at points where meetings are held, and with numerous workers constantly weaving back and forth from one corps to the other. Care is always taken to have the same conductor or assistant conductor at his meetings throughout.

We shall use this year the usual blank forms for reporting institutes merely changing some details. With the reports, copies of programs should be submitted, indicating necessary changes that were made in speakers, order of subjects or otherwise.

Conductors will be furnished with little slips to be passed through the audience asking for names and addresses of those who are in attendance who wish to have bulletins sent them, also the phase of agriculture in which they are particularly interested will be noted. These same slips may be useful in locating institutes another year.

The usual forms of expense blanks and vouchers will be used, and the main office will endeavor to handle these promptly if they are received when expected.

Our institute workers deserve great credit for the present development of our agricultural institutions. They have taken occasion to mention these institutions and make them known to the farmers and that practice should continue. The facilities for training young men and women and older men and women are known to you, and something along this line may well be said at every meeting.

This year we will endeavor to give more emphasis to subjects of special interest in the different communities. More attention also will be given to the farm home. There seems to be a disposition to drop the term "women's institute" partly because the words suggest that they are exclusively for women. We are substituting the term "farm home institute." There will be a woman speaker at almost every meeting throughout the entire season, and farm home subjects will be frequently presented by her as well as by some of the men speakers. Occasionally, however, there will be special sessions for subjects exclusively in the interest of the farm home.

And this year much attention will be given to bovine tuberculosis. It is one of the most important of the subjects we have to deal with. There has been some misunderstanding in regard to the State law relating to tuberculosis. This line of work was placed within the jurisdiction of the Department of Agriculture five years ago. During that time until last June the law remained the same, then a bill was passed making several changes in the law, among others increasing the rate of indemnity, but this bill was vetoed by the Governor. One of his reasons was that the bill increased the indemnity nearly 100 per cent., which sounded good, but unfortunately it did not provide additional money with which to pay these larger indemnities. However, during the special session of the Legislature immediately following the regular session, Governor Hughes sent to that body a recommendation that suitable legislation on bovine tuberculosis be enacted. The result was that the good features of the bill which he had vetoed were brought before the Legislature with certain other minor but important provisions and that bill was passed. At the same time an additional appropriation of $75,000 was made. We may now claim to have as good a bovine tuberculosis law as is operative in any state. Under this law any farmer may apply to the State for aid in freeing his herd from tuberculosis. He may ask for a physical examination if he wants it. We will provide the physical examination and at the same time explain to him what the tuberculin test is. With proper understanding of the facts, most farmers will want the tuberculin test even though they first asked for the physical. Although there has been some sensational talk against the tuberculin test, we find that even now about 90 per cent. of our applications are explicitly for that test. Some ask for physical examination first and then if tuberculosis is indicated, they want the tuberculin test. This work is so organized that it is being cared for promptly. After veterinary examination the condemned cattle are appraised, and all that show the disease upon physical examination are slaughtered. Those which react to the tuberculin test, but appear sound physically, may be retained by the farmer if he desires and kept under the so-called Bang method, or they may be slaughtered. It is advised that valuable animals be saved. The young stock from such animals will be born healthy and if fed upon healthy milk they will continue healthy. A herd in connection with the Geneva Experiment Station was treated in this manner. Its milk was pastuerized and was used by Director Jordan and his staff in their homes. In the course of a few years the diseased herd was replaced by a healthy herd with the least possible loss.

I will not talk about the need of good, conscientious work in our institutes. Most of you are more experienced in practical institute work than I am. I acknowledge that I found some instructive reading in the papers of those gentlemen who were kind enough to take the civil service examination for farmers' institute conductors, although they had served for years as conductors. After those papers were marked and recorded I saw them for the first time and read with profit what they thought should be done to make the institutes in this State better.

Anyone who has watched closely the institute work in New York State realizes that it is work of high grade. One of the most commendable things about it is the splendid feeling of loyalty that exists on the part of the workers and between the workers and the Department, and it is my earnest hope that this will continue. Personally and officially, I shall do everything in my power to make the coming season the best in our history. I am glad to feel that we all start the season's work with the same ambition.

Soil Fertility

By T. L. Lyon

Professor of Experimental Agronomy, New York State College of Agriculture at Cornell University

The potentially available nutrients in a soil, whether natural or added in manures or fertilizers, are only in part utilized by plants, and the extent of their utilization depends upon the operation of certain limiting factors. This is a very important consideration in the manuring of land, for under conditions as they frequently exist the use of fertilizers is wasteful and extravagant.

The factors affecting the availability of fertilizing material that can be controlled are the following:

Soil moisture content.
Soil acidity.
Quantity of organic matter in the soil.
Structure or tilth of the soil.

An undesirable condition of any one or more of these factors is a very common and apparent occurrence, and yet fertilizers are expected to produce profitable returns.

SOIL MOISTURE CONTENT

Soils in this region commonly suffer from an excess of water in the spring and a deficiency in the summer. Cereals and many other crops require the largest quantity of water at the time of heading and blossoming, and the largest production of crop can only be secured where the supply is adequate at that time. It is safe to say that in the great majority of cases crops raised even in the humid region suffer at some time from a deficient water supply. On the other hand, we are all well aware that our crops, almost without exception, suffer either by lateness of planting or by delayed early growth from an excess of moisture in the spring.

A control of the soil moisture supply should, therefore, remove the excess of moisture in a time of large rainfall and conserve it in time of drought.

1. Drains, especially by means of tile.
2. Use of green manures or other organic matter.
3. Good tillage.

DRAINS

Of all the devices for draining land none is so effective as tile pipe. Viewed purely from the standpoint of soil fertility, tile drainage does much to increase crop production and to effect economy in the use of fertilizers. The relation of soil drainage to soil fertility may be summarized as follows:

1. Aeration provided by the removal of water greatly facilitates nitrification, thus relieving the constant necessity for the use of soluble nitrogen fertilizers, and making it possible to rely largely upon the use of leguminous crops for nitrogen fertilization. Aeration also renders the other fertilizing constituents of the soil more easily soluble.

2. By quickly removing the excess moisture in the early spring and thus increasing the length of the growing period, there is a corresponding increase in the length of time in which nitrification can take place. Available nitrogen thus produced at an early period in the crop growth is more effective than a later supply would be.

3. By removing an excess of water from the soil a larger proportion of the available fertility, both natural and that added in manures, is absorbed by the crop. This is because the solution is less dilute, and consequently a larger amount of mineral nutrients pass through the plant by transpiration.

4. With a very small moisture content, the absorption of nutrients by plants is large as compared with the production of organic matter. This means an extravagant use of fertilizing material in crop production. The amount of organic matter produced determines almost entirely the size of the crop. Drainage, by increasing the water holding capacity of the soil in time of drought, causes a more economical production of organic matter, as measured by the fertilizer consumption of the crop.

ACIDITY

An acid condition of the soil renders ineffective a large proportion of the fertilizing material that might otherwise be available. A good illustration of this is to compare the crops grown on acid soil, when treated with lime, with a similar soil not so treated. The size of the crop on contiguous plats has been increased several hundred per cent. by the use of lime at a number of the experiment stations. The amount of the acidity determines the injury it occasions. There is always a great waste of fertilizers when they are added to an acid soil. The acidity should be corrected by the application of lime in order that manuring shall be most effective.

There are several ways in which an acid condition of the soil operates to render ineffective the natural and applied fertility.

1. Bacteria which are concerned in the processes of rendering available plant food do not usually thrive in an acid media, preferring a neutral or slightly alkaline condition. Acidity for this reason checks nitrification, as well as the bacteriological processes by which phosphorus is rendered soluble.

2. Bacteria concerned in the acquisition of atmospheric nitrogen in symbiosis with legumes are greatly injured by an acid condition of the soil. Nitrogen conservation, the most important feature of the use of legumes, cannot be effectively carried out on an acid soil.

3. The liberation of potassium from zeolitic combinations is best effected only where there is a basicity that will permit the replacement of one base by another. The presence of at least a small amount of calcium carbonate in the soil is essential for this, as it is for many other desirable processes, and an acid condition of the soil means that no basicity exists.

4. Lime is able to act on the very insoluble phosphates of iron and alumina, and by converting them into phosphate of lime, renders the phosphoric acid more available for the plant.

ORGANIC MATTER

The organic matter of the soil has a strong influence on the availability of difficultly soluble phosphate fertilizers and upon the availability of many other plant nutrients contained in the soil. Organic fertilizers are therefore a valuable supplement to mineral ones. It is wasteful to continue the use of mineral fertilizers if the soil is deficient in organic matter.

The ways in which organic matter contributes to soil productiveness are:

1. By improving the tilth.
2. By conserving moisture.
3. In the process of decomposition carbon dioxide is evolved in large amounts, and this dissolved in the soil water is a slight but continuously acting solvent upon the mineral matter of the soil, gradually carrying into solution the mineral constituents.
4. It furnishes a source of food and energy to the bacteria of the soil, many of which are of great importance in plant growth.

Farm manure is undoubtedly the best all-round fertilizer to be had. In addition to adding organic matter and certain mineral plant food materials, it introduces into the soil and furnishes a favorable medium for the growth of large numbers of bacteria that are of great value in rendering available the plant nutrients contained in soils.

TILTH

The word "manure" originally meant "to work with the hand." This probably arose from the observation that farm manure, which was the only manure in use at that time, made the soil less cloddy, and as tillage produced the same effect they were supposed to have the same function. While tillage does not take the place of manure it is fully as important, and unless the soil is well fined a large part of the fertilizing matter is lost.

Tillage aids the plant to obtain nutrients from the soil in several ways.

1. By promoting aeration.
2. By permitting the plant roots to come in contact with a large area of soil.
3. By conserving moisture in time of drought. Cultivation of hoed crops, like corn, is of great importance in this way.

CONCLUSION

Changes in basicity, organic matter and tilth account for the increasing need of fertilizers on fertilized soils.

A large part of the fertilizers now used can be saved by the use of lime, green manures, drainage and good tillage.

DISCUSSION

Question.— Have you any figures to show how much lime it would take to neutralize acid to a depth of a foot?

Professor Lyon.— We do not know exactly what soil acidity is. It is possibly due to the presence of organic acids or possibly to insoluble acid salts or perhaps to both. Several methods have been devised to determine acidity in soil. Of these the one that shows how much lime the soil will take up is probably of the most practical value. Some of the land on the university farm shows a lime requirement of as much as one and one-half tons of lime per acre when tested by this method. That, however, is no indication of what other soils may need. A good way to ascertain how much lime a soil needs is to add different quantities of lime to different strips of land and see which quantity gives the best results.

Treatment with lime is more a matter of obtaining a certain basicity of the soil than of neutralizing acidity.

Question.— What do you mean by the term "basicity"?

Professor Lyon.— I mean a sufficient amount of the base forming elements of the soil to combine with all of the acid forming elements. There should be enough of the bases present to prevent the existence of free acids, particularly mineral acids, but also enough to satisfy the organic acids and the zeolites, and at the same time to leave in the soil some lime in the form of calcium carbonate. It is only when these acids are all satisfied that calcium carbonate is found in the soil. A soil containing calcium carbonate in solution remains in good tilth, responds readily to fertilizers and manures, and permits the ready decay of organic matter. Liming is beneficial for these reasons.

Question.— What do you mean by the term "zeolites"?

Professor Lyon.— Zeolites are combinations of silicic acid with a number of bases, as, for instance, aluminum, calcium, potassium and sodium together with water of crystalization. The bases in these compounds are replaceable so that potassium, for instance, may be replaced by calcium. These compounds are very slightly soluble, but when lime is abundant in the soil it will replace potash in the zeolite, and the potash will then go into solution, in which form the plant can use it.

When the soil is acid this reaction does not go on readily, and the potassium remains in an insoluble form.

Question.— Would the liming of alfalfa soil have a large effect in the way of plant feeding?

Professor Lyon.— Yes, it would have a very important effect on alfalfa, especially in producing a more favorable medium for the development of bacteria.

Question.— This question in regard to the using of calcium carbonate as against the use of calcium oxide — which is preferable at certain prices? Which should the farmer be advised to use?

Professor Lyon.— As to price, I think I would rather ask some one else to discuss that. As to the effect, I would say that oxide has a quicker action, but in a long series of years the effect is much the same.

Question.— Can you explain the use of calcium carbonate against the use of limestone?

Professor Lyon.— There is one thing about ground limestone. The composition of it will vary a great deal, and unless one knows how much calcium carbonate it contains he may be very badly fooled. It is important that limestone be finely ground. Marl is in a more finely divided condition than ground limestone. Whether limestone would be as good on alfalfa soil, where the reaction would be as important as it is there, is questionable. If used in large enough amounts it would give us the bases that we require, but whether it would neutralize with sufficient rapidity the presence of any acid that might be present to bring about the conditions most desired for the development of the alfalfa bacteria, I do not know.

Question.— Would you not in all cases advise the working of the lime into the soil?

Professor Lyon.— Yes, I would advise working it in at the surface of the ground, but not going too deep.

Question.— What do you mean by deep?

Professor Lyon.— I would not plow it in, because it will work down through the soil anyway. Better to work it under with a disc or harrow than to plow it under.

Mr. Witter.— Alfalfa carries a large amount of mineral matter. Are we to understand that lime has perhaps as much effect in giving to that plant larger bases to make available mineral matter than the correction of acids in the soil?

Professor Lyon.— In growing alfalfa there are two different conditions that we want to bring about. In the first place, we want to get enough nutrient material in the soil so as to give us the mineral nutrients that the plant requires. In the second place, we want to have in the soil favorable medium for growth of the bacteria on which alfalfa is dependent. Lime gives both of these conditions. If the soil is acid the potash and phosphoric acid are not readily available. If we add lime we set free the potash and phosphoric acid that is required for the plant. If there is any acid present in the form of organic acid, we will neutralize it. I think it is very frequently the case that alfalfa and clover do not grow well when there is not an actual acid condition of the soil, but where there is a need of lime as would be shown by the amount of lime that the soil would take up. In that case it would be largely the presence of lime in sufficient quantities to furnish food for the plant that would be desirable.

The Use of Lime

After an informal talk on lime by George W. Cavanaugh, professor of agricultural chemistry at the New York State College of Agriculture at Cornell University, the following questions and answers were recorded.

Mr. Van Wagenen.— Is there any possibility that a direct application of quicklime unchanged from the kiln would be in any way injurious?

Professor Cavanaugh.— As far as I know, if that application is not heavy there would be no injury caused; the moisture of the soil would very soon slake it. You refer of course to ground quicklime. In various parts of the State there are beds of dolmater, and I do not think that we would run any risk in recommending it to the farmer. Dolmater limestone carries magnesia as well as lime, as we find by analysis of the lime from the dolmater limestone. I cannot say that we are changing the relative weights.

Mr. Stevens.— You think, then, that lime in the soil increases bacteriological action and growth?

Professor Cavanaugh.— I think that there is no doubt about that whatever. Three years ago at the farm of the Agricultural College we limed some alfalfa soil, and during the season took out samples of soils weekly and determined the nitrates. The limed portions showed uniformly a higher quantity of nitrate than the unlimed. The increase in nitrates is undoubtedly due to the increased action on the part of the nitrate-forming bacteria; hence we believe that the addition of lime itself promotes bacteriological action in the soil.

Professor Harding.— You have examined a good many soils in this State as to their acidity. How did you find the average soil relative to acidity?

Professor Cavanaugh.— It is hard to say, because the types of soils sent in for examination would be those that other conditions would indicate were acid. Hence they would not be a fair average of the agricultural soils in the State. Practically all of the samples sent in have been found to be distinctly acid.

We have not been recommending an application higher than one and one-half tons of lime per acre, even though the indications called for a higher amount.

Mr. Curtis.— Why is the soluble form used if after application it returns to the insoluble form?

Professor Cavanaugh.— The soluble form is used because during the short time that it remains soluble in the soil it is very widely distributed before it becomes fixed in the insoluble condition. If one could grind the raw rock to the same degree of fineness as this soluble form becomes after fixation, we believe that then the raw rock might have nearly the same degree of availability. This fine grinding is a practical impossibility.

Mr. Ward.— In case farmers want lime to apply to soils, what would be the objection to recommending marl?

Professor Cavanaugh.— If it is finely ground a high percentage of pure marl is as good as air-slaked lime.

Question.— What would be a high percentage of marl?

Professor Cavanaugh.— I recently examined samples of marl from Cortland county which showed a purity of eighty-eight per cent. Fifty-six per cent. of that figure would be lime.

Mr. Witter.— Many times the question is asked, "What is the difference in weight and value, and how much water is driven off in the burning of lime?"

Professor Cavanaugh.— Assuming the limestone to be pure, one hundred pounds of limestone burned will give fifty-six pounds of quicklime. If that is dry-slaked with water that powder will weigh seventy-four pounds, and if that is thoroughly air-slaked it will go back to the original one hundred pounds.

Mr. Witter.— Would you say that litmus paper was of no value to the farmer?

Professor Cavanaugh.— No sir. Where you get definite positive tests with the litmus paper, there is no question whatever that there is an acid condition present.

Farm Management

By J. L. Stone

Professor of Farm Practice, New York State College of Agriculture at Cornell University

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As a topic for discussion this sounds well. But if I were to ask each of you what you understand by the term, I imagine I should get exceedingly various replies, and no doubt in the minds of some the subject would be rather hazy. I confess that in my own case I am somewhat at a loss how to express my conception of the subject. How will this do? Farm management has to do with coordinating the activities of the farm, as to their character, extent, order in time and method of performance, so as to produce the most satisfactory results. Many factors may enter into the question as to what constitutes satisfactory results. Usually the profitableness of the enterprise, taken as a whole, will receive chief consideration. Frequently the excellence of the articles produced will have an important place. That excellence may consist in beauty, flavor, form or size, or any other characteristic that gives pleasure or benefit. Usually, but not always, excellence is in close relation to profitableness. Sometimes the effect of the activities conducted upon the farm on the general well-being and appearance of the farm itself will be a large factor in the satisfaction realized. On many a farm profit is sacrificed, to a greater or less extent, to appearances. This frequently occurs on the farms of the wealthy and of lovers of the beautiful.

Fortunately, those habits of orderliness and neatness that result in attractive appearances also contribute to profitableness unless they are carried to an extreme. I suppose, then, that a farm that is so managed as to maintain its productivity and attractive appearance, that its products are of a high order of excellence and that results in a fair rate of profit, may be said to be well managed.

If I were able to lay down rules for farm management, by using which one could invariably secure the results named above, I am sure you would allow I would be doing a great thing. This, however, I cannot do. But possibly I may be able to point out some of the factors that must be reckoned with.

When our worthy Commissioner of Agriculture asked me to speak to you on farm management, he made it plain that it was with a view of giving me an opportunity to relate some of my observations while on a recent brief visit to Great Britain. I am to point out some of the differences and the similarity between American and British conditions and methods and, if possible, make some suggestion that will help us in our study of problems in farm management.

In the first place and taken in a broad way, I was much impressed with the thought that the English farmers are adapting in an admirable way their systems of husbandry to the conditions in which they are placed. The crops and animals selected for production are excellently adapted to the climate, soil and markets of the localities where they are grown.

It seems to me that there are few questions pressing harder for careful consideration by American farmers than this one. Few farmers give it the thought they should. While traveling in the great dairy district of Cheshire, I was surprised to see nearly all the land in grass. On some farms no plowing is done at all. A little later I was shown at the Agricultural School Farm at Holmes Chapel an eleven-acre field that had carried twenty dairy cows throughout the season. In June it was necessary to turn in a flock of sheep to help keep it down. Even then it was found desirable to clip it with a mowing-machine. It is true that such a record is unusual even in Cheshire, but where it is possible to grow grass like this, or anywhere near it, it certainly is wisdom to keep the land growing grass much of the time.

You are asking, "How was this field managed to make such results possible?" I am not able to give you the details of its management, but of course it was unusually well cared for, as it was the pride of an expert. Undoubtedly there were three principal factors contributing to the result — climate, soil and treatment. Each of these factors is important in crop growing and in this case each was of the highest order. While it is not a matter capable of demonstration, I am strongly of the opinion that the relative importance of these factors is in the order named — climate, soil, treatment. While the treatment given in this case was excellent and the soil just the kind for best results with grass — a strong clay loam, lying nearly level, but well drained — I believe it is to the climate of England that we must look for an explanation of the famous yields of grass there secured, as well as of some other crops I shall name shortly. The winters are mild, so that the vitality of the plants is not weakened by excessive cold. The summers are never very hot and the moisture supply is almost always abundant. These are the climatic conditions that in conjunction with the excellent soil and wise management make the result I have named possible. This climate also makes it possible for the English farmers to grow good grass on other soils of a character such that if they were in New York, with its own excellent climate, they would lie brown and sear through much of our hot summer. The traditional excellence of English agriculture I should, therefore, attribute to the peculiar climate of the country and to the wisdom of the farmers in devoting their energies in the main to those lines of crop and stock production that are best adapted to that climate and to the various soils. As to markets, they have good demand for nearly everything they can produce, owing to the dense population, of which only a small proportion are engaged in agriculture.

Other products that are extensively grown are oats, roots, potatoes, beef and sheep. The crops named are as well adapted to the climatic conditions as is grass. The animal industry, in its excellence, is made possible by the grass and roots.

Before making the visit, I was well aware that roots and sheep were important items in British agriculture, but it was one of my chief surprises to see the very large place they take. Roots and sheep supplement one another admirably in this country, but in England to a much greater extent. In the first place, owing to climatic conditions, the roots are grown there much more easily and consequently more abundantly than they well can be here. The English farmers practice hurdle feeding to quite an extent. This saves the man labor of harvesting the crop and at the same time saves drawing manure to the fields, as the hurdling is so managed as to secure a sufficient and even distribution of the manure.

Owing to climatic conditions, the feeding off of turnips and other succulent crops like rape, kale, etc., may be continued well into the winter. Then, in addition to this, the feeding of the harvested roots upon land that it is desired to manure may be continued almost throughout the winter. Thus it is that the climate makes the growing of grass and roots comparatively easy and inexpensive, and the grass and roots make the sheep.

I have been much interested in the utilization of the cheap and semi-abandoned farm land in some parts of New York, and have wondered how it is that the English farmers can make a success with sheep on land that costs them as much for annual rental as would purchase the New York lands referred to, while most of our farmers shy at sheep growing. In view of the special adaptation to sheep growing of the English conditions, we may not expect to equal the English farmers in this line, but I do believe there is good opportunity for success with sheep in many localities where cheap lands are to be found. Sheep farming can well be conducted upon rather large areas of land. In the south of England the farms range from 500 to 1,000 acres or more. Sheep farms need not be located as conveniently to the railway stations as would be necessary if milk production were contemplated.

The fencing should be thoroughly done with special reference to restraining and protecting the sheep. The outlay for buildings would be much less than required in case of dairy farming. The same is true as regards labor. Selected areas could be used for growing roots, alfalfa and other hay for winter keep. Rape could be grown to help out the pastures and for finishing off in the fall. If, after the enterprise was well started, it were found desirable to increase the winter work in order to give all-the-year-round employment, a portion of the flock could be devoted to the production of winter lambs. Many farmers who keep a few sheep have told me in recent years that they find them among the most profitable lines of their farming. I look for the day when sheep growing in New York will regain the importance it had fifty or sixty years ago.

I found the potato to be another crop that is peculiarly favored by the climatic conditions in Great Britain. The farmers of England speak of ten or twelve tons per acre (about 400 bushels) in

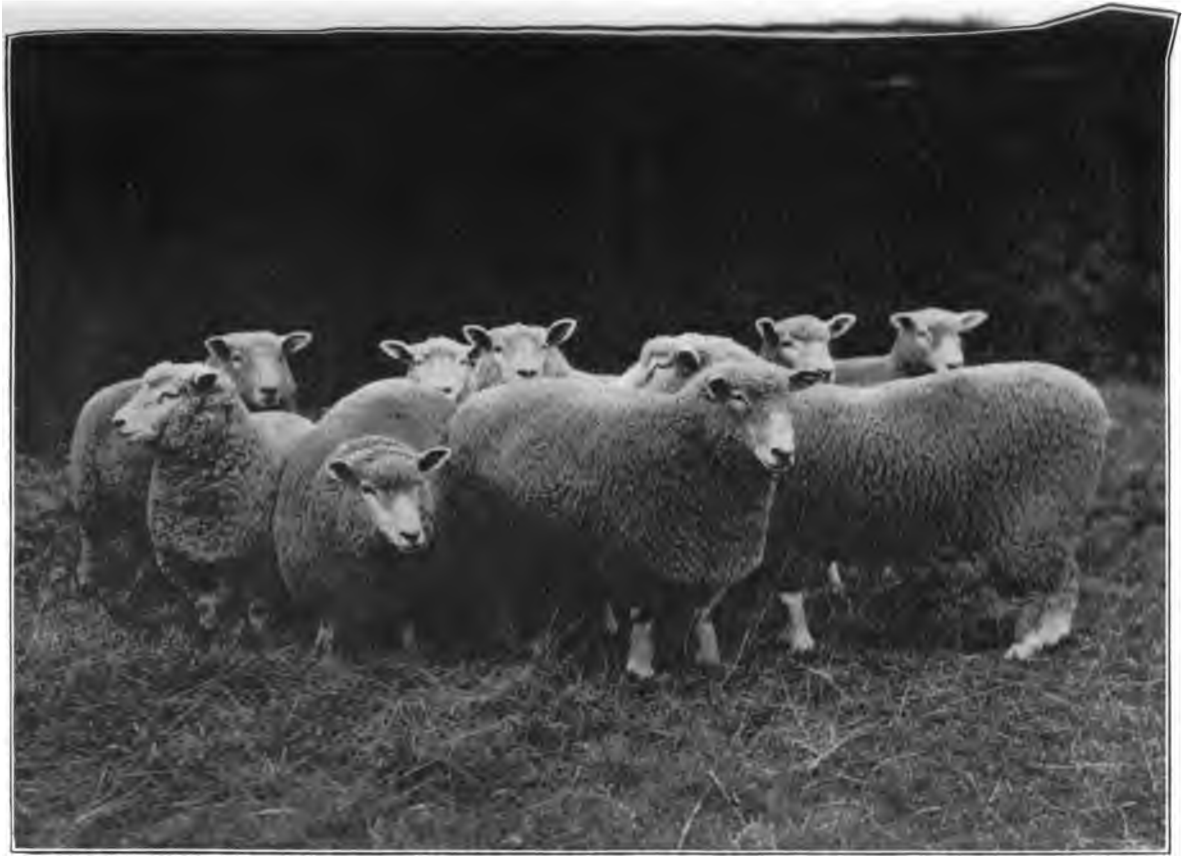

Fig. 1.— A Prize Winning Bunch of Ryeland Ewes.

Ryeland sheep were developed on the lighter soils of southern Herefordshire and are especially adapted to localities where it is desired to finish them without extensive use of "cake and roots," as they finish well on

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about the same way as our American farmers refer to 200 bushels. Here the average yield is less than 100 bushels per acre, but the statistical report of Great Britain places their average crops in the vicinity of 240 bushels. In the south of Scotland I found the most highly developed potato culture that I saw. On Lord Rosenbury's estate at Dalmeney, high-grade potatoes for seed are a specialty, and I was told that their entire area, which usually is about 100 acres per season, not infrequently averages twenty tons per acre and that their especially heavy crops reach forty to fifty tons. I saw a hill dug from the test plats which yielded thirty-two merchantable tubers, and Mr. Sinclair, the manager, told me that a few days before he dug a hill which produced fifty-four merchantable tubers. To American farmers this seems almost incredible, but with their highly developed varieties, their excellent potato soil highly manured and fertilized and the climate that remains moist and cool through an entire season, the Scotch farmers are able to secure yields altogether out of reach of American farmers, with our greater heat of summer and probability of a dry spell during the season of most active growth. The soil, the fertility and the skilful management we can duplicate, but the remarkably favorable climate is beyond our control.

I wish also to say a word as to the comparative excellence of American and English farming. We can do as good farming as do the Englishmen and some American farmers are as skilful as they, but the American average is far below the English. I see two principal causes producing this result. First, the system of land tenure, undesirable as we would consider it from other considerations, does tend to excellence of farm management. The density of population and the inability of as many farmers as desire to do so to secure farms to operate is the other factor. The landlord will not lease his farm except to men of sufficient means, practical experience and ability to accomplish good results, and there being many times as many would-be farmers as there are farms gives large opportunity for selection. I was told that in case a poor farmer died there probably would be fifty applicants for his farm before he was under the ground. The great ease with which land is secured in America makes it possible for very many who have neither the capital, experience nor ability that would enable them to successfully manage land, to secure farms and the result is that our average farming is not very high.

Again in regard to roads. I have heard Americans very severely criticized for not maintaining roads that are comparable with the English roads. I know that our roads are not what they should be and I am anxious that they should be rapidly improved, but I do not believe that Americans are censurable in the degree that some have represented. The roads of England are remarkably fine. Scarcely will you find a common road that is not thoroughly macadamized; not only so, but it is maintained in most excellent condition by a thorough system of annual repairs. But we must remember that this result has not been attained in a century or two. Most of these roads were made even before the days of steam transportation, when good roads were a more pressing necessity than at the present day. Consequently they were under greater stimulus to improve the roads. Many of the roads were for military purposes and were looked upon as a necessity for national protection. While I hope to see improvement in American highways continued and even at an accelerated pace, yet I do not feel that because our present roads are inferior to those of Europe that we are especially censurable under the circumstances.

Animal Nutrition

(A statement of the simple fundamentals of animal nutrition.)

BY DR. W. H. JORDAN

Director of the New York Agricultural Experiment Station

The animal body is a product of the food; animal growth one of Nature's manufacturing processes. The same is true of commercial animal products such as milk and wool. The energies of the animal are sustained by the food, such as the beating of the heart, the movements of the intestines and all forms of external work.

An understanding of the relations of food to animal life and production and knowledge of what food is and how it is used in building and sustaining the animal body is essential to a comprehension of how it produces these results.

COMPOUNDS OF CATTLE FOODS

These are divided into four classes, namely, the mineral substances, the proteins, the carbohydrates and the fats. The so-called mineral compounds are principally what is left after the complete ignition of a sample of food. This unburned residue is called the ash and contains principally phosphoric acid, sulphuric acid, chlorine, potash, lime and magnesia. The proteins as a class include nearly all those substances in the plant that contain nitrogen. Common proteins are those in the gluten of wheat, the white of the egg and the red flesh of the animal body. The carbohydrates are bodies containing no nitrogen and are represented by starch, sugar and gums. The fats, also, contain no nitrogen, common illustrations of which are linseed oil, cotton-seed oil, corn oil, lard, tallow, butter, etc. A carbohydrate-like material that bears an important relation to the value of cattle foods is crude fiber, which varies greatly in amount in different foods and affects their nutritive value.

THE COMPOUNDS OF THE ANIMAL BODY

The animal body contains the same classes of compounds as plants. When the animal body is burned there is left an ash largely from the bones. This ash has principally the same compounds as the ash of plants. The proteins of the animal body are found mostly in the red flesh; in such organs as the heart, liver, lungs, kidneys and the blood vessels and in the head, hair, hoof, horns and so on. The fats are located in special parts, such as the deposits around the kidneys and along the intestinal tract and intermixed with the muscular tissue. The animal body differs from the food from which it is constructed in containing practically no carbohydrate material excepting a small amount of sugar in the blood circulation.

THE ANIMAL AS A WORKING ORGANISM

The animal organism performs work both internal and external. The internal work is illustrated by the beating of the heart, the mastication, digestion and movement of the food through the intestinal tract, transfer of the food into the blood circulation and the chemical force involved in the application of the food to growth and other needs. All these forms of work are sustained by the potential energy of the food; energy that was stored in the plant at the time of the plant's growth.

HOW FOOD BECOMES AVAILABLE FOR USE TO THE ANIMAL ORGANISM

The first process is the mastication of the food in order that it may enter the digestive apparatus. This mastication is much more energy consuming with coarse, dry fodders than with green material or with grains. The next general process is the dissolving of the materials of the food in order that they may be transferred to the parts of the body where they enter into use. Food is not used for any purpose until it is taken into the blood circulation. This requires solution, which is accomplished by juices poured upon the food as it passes along the alimentary canal. These juices are the gastric juice of the stomach, the pancreatic juice, which comes from the sweetbread and is poured into the small intestines, and the bile, which is also poured into the small intestines. Other juices have their influence also. These juices so act upon all the classes of nutrients that exist in cattle foods as to make it possible for these to be passed through the walls of the intestines into the blood circulation, in which they are distributed to the body. Cattle foods differ greatly in solubility or digestibility, such materials as poor, coarse fodders like straw being more than half insoluble, while certain grains like corn, wheat and barley are dissolved to the extent of 85 to 90 per cent. Nearly all foods contain some indigestible matter. The part of the food that is not digested passes out as the solid excrement or feces. The feces is mostly the waste part of the food. Certain conditions modify digestibility, such as the age of the plant. Ripened grass is much less digestible than young grass; cooked food is sometimes less digestible than uncooked. A very heavy ration may be digested to a less extent than a moderate one.

HOW FOOD NUTRIENTS ARE APPLIED TO THE USES OF THE ANIMAL

After the food is dissolved and passed into the blood, it is used for various purposes. The mineral substances such as found in the ash are used to form bone and to supply the necessary mineral matter in the flesh and certain compounds in the digestive juices. The proteins of the animal body, such as the red flesh, head, hair, etc., are formed from the proteins of the food. The fat of the body in most animals is formed largely from the carbohydrates, that is, the starch and sugar-like bodies, but probably may be formed from the fats in the food and possibly from the proteids. In the case of milk it is known that the casein or cheesy matter in the milk must come from the proteids of the fat, while the milk fat may come from the carbohydrates of the food, the milk sugar having probably the same source. Milk contains a generous amount of mineral matter which comes from similar substances in the food. Proteins, carbohydrates and fats of the food, which may all be oxidized (burned), serve to sustain the work the animal organism does, both internal and external. It is a mistake to speak of any one class of food as heat producing. A pound of linseed meal will produce as much or more heat as a pound of corn-meal. A pound of digestible fat will produce about two and one-quarter times the amount of energy or heat that a pound of digestible carbohydrates will; the carbohydrates and proteins being about equal in energy or work value.

The energy of these food nutrients is liberated by the oxidation or burning of these materials in the body. This oxidation takes place in the tissues. The oxygen is furnished through the lungs from the inspired air, and is transported to various parts of the body by the lungs. The more work an animal does the larger the amount of oxygen used. The oxygen used is a measure of the work done.

NEEDS OF THE VARIOUS CLASSES OF ANIMALS

The food needs of one class of animals may differ materially from the needs of another class. Young animals need material for constructive purposes, that is, the laying on of flesh and the building of bone and other parts of the body. Young animals, therefore, need more flesh forming and bone forming material than mature animals. This means an abundant supply of the proteins and of mineral compounds. The young animal must also be supplied with sufficient energy to keep up the activities of the organism. Fattening animals, if mature, need for constructive purposes materials that will form fat; a purpose which carbohydrates will serve. A certain amount of the proteins is also necessary to sustain the functions of the body, but not in the same proportion as is the case with a growing animal. Milch cows, which are producing organisms, need not only to have the producing organism kept in operation, but they need raw material for the formation of milk. This requires proteins to build the milk casein and albumen, carbohydrates to build the milk fat, which may also be accomplished possibly by the food fat, and mineral matter to supply mineral compounds for the milk. The cow, as a working organism, uses much energy for internal work and she must be liberally supplied with food fuel. Working animals, if mature, use food largely in the production of external work; work that is performed chiefly at the expense of the carbohydrate material, although the proteins should not be deficient. With all animals protein waste is constantly occurring which must be made good from the food.

DISTRIBUTION OF USE AMONG THE VARIOUS CLASSES OF NUTRIENTS

With all animals, excepting possibly those very young, much the larger portion of food is used for sustaining internal and external work. For instance, in case of a well-fed milch cow that uses a larger proportion of her food for production than any animal, excepting a very young one, less than one-third of the digestible nutrients is applied directly to milk formation, the other two-thirds being largely used to maintain the energy needs of the milk producing machine. This is important in view of the fact that energy or fuel foods are produced in abundance on the farm. The carbohydrate and fat portion of the ration may be from five-sixths to seven-eighths of the weight of the nutrients in the rations of mature animals. With any animals, except very young, only a minor portion of the digested nutrients is actually applied to constructive purposes or to the replacement of the waste of tissue.

THE CLASSIFICATION OF CATTLE FOODS

These may be classified in two ways, (1) by chemical composition, (2) by the type. The chemical classification is based on the relative proportions of the different classes of nutrients, particularly in the proportion of protein as compared with the carbohydrates and fats or non-nitrogenous parts of the ration. Cattle foods having particularly high proportion of protein present are cotton-seed meal, gluten meal, distillers' dried grains, gluten feeds, malt sprouts, brewers' dried grains and pure buckwheat middlings. Cattle foods having specially low proportions of the proteins are the straws, timothy hay and the other true grasses, also the cereal grains, the latter having more protein, however, than the previous coarse fodders mentioned. First-class clover and alfalfa hay stand a little higher in the scale, while above these and below the protein feeds mentioned stand wheat bran, wheat middlings and a few other materials. There is a sliding scale of the proportion of protein from cotton-seed meal down through a great variety of materials to poor, coarse fodder. On the other hand, those foods low in protein are correspondingly rich in carbohydrate or other non-nitrogenous material.

Cattle foods differ in type, such as the coarse fodders as distinguished from the grains. This is due to a chemical reason, however, the former having much crude fiber and the latter very little. This is a classification of foods in their natural condition. We have another type of cattle foods not easily classified, namely, the compounded feeds that contain both grains and fibrous materials. These will be dealt with later.

VALUATION OF CATTLE FOODS

Frequent inquiries are made as to relative money value of different cattle foods. A fixed scale of money values is not possible. Foods of the same class are valuable in proportion to the digestible dry matter which they contain and their values may be compared on this basis. Only the digestible matter is useful, the indigestible portion being waste. On this basis hays may be compared with hays, straws with straws, cereal grains with cereal grains and high protein foods with high protein foods. Unlike foods cannot be compared as to money value on any basis now known. Carbohydrate material is essential to a ration, so is protein, but the relative money value of protein and carbohydrates cannot be established on any known basis. For this reason cotton-seed meal cannot be compared commercially with corn-meal. There is a tendency to estimate the value of a food proportionately to its per cent. of protein. This is not a sound basis. Two foods with the same proportion of protein may be greatly unlike in value because of the presence in the one of indigestible material, such as oat hulls, corn-cobs or similar substances. In this way, wheat middlings having 16 per cent. of protein or thereabouts may be much more valuable than a compounded feed having enough cotton seed in it to bring up the protein to 16 per cent., this cotton seed being associated with oat hulls. The value of all the compounds of a cattle food must be taken into account. Farmers must consider the kind of materials in a cattle food as well as its percentage composition. In selecting feeds to purchase, a farmer should decide what class he needs and then select from that class on the basis of comparative digestibility and price.

It was formerly held, in practice at least, that a pound of digestible matter of a given composition was equally valuable from all sources. We now know this not to be so. The real nutritive value of any digestible material is the balance of matter or energy which may be applied either to growth or to some other form of production. We now speak of the net value of cattle foods, which means the balance of energy after deducting the energy cost of masticating, digesting and assimilating the food. It costs the animal more in the way of work to prepare and apply to use the nutrients from hay than it does from corn-meal or any other ground cereal. It costs more to utilize dried fodders than it does green fodders. For these reasons the net value to the animal of a pound of digestible dry matter from the grains is greater than the value of the same amount of nutrients from coarse fodder. It is estimated that the difference is not far from 20 per cent. in favor of the digestible nutrients from the grains. This means that the most efficient ration, physiologically speaking, is the one that contains the maximum of grains and the minimum of coarse fodder.

THE SYSTEM OF FEEDING

Rations should be compounded with reference to two factors, (1) the physiological needs of the animal, (2) the business conditions involved. A system of feeding involves much more than mere compounding of a ration with reference to a proper balance of the nutrients. The system of cropping on the farm and market conditions, both as to cattle foods and the products sold, must also be considered. It is important to economically meet the physiological needs of the animal for sustaining a profitable rate of production, but, on the other hand, the most perfectly fed animal is not necessarily the most profitable one. In other words, it may be more profitable to depend upon home-raised materials with minimum buying of outside materials, rather than to purchase more largely in order to secure the ideal ration. The physiological welfare of the animal and the demands upon the food for profitable production are fundamental considerations, however. Underfed animals are seldom profitable and overfeeding is dangerous. The standard rations published in feeding tables are, in the main, useful guides in compounding rations. For instance, a productive milch cow of average size will hardly be the most profitable with less than fifteen or sixteen pounds of digestible material per day, and of this quantity there should not be greatly less than two pounds of digestible protein, more protein being an advantage with a highly productive cow. Such a ration may be made up in a great variety of ways; there being no best ration so far as particular materials are concerned. At the same time the standard rations may wisely be deviated from under certain conditions. For instance, where the farm produces an abundance of good forage, with a generous supply of either clover or alfalfa hay and a sufficient quantity of silage from mature corn, a ration with a minimum proportion of protein, possibly not over 1.7 pounds of digestible protein per day, may be more economical even with a lower rate of production than to purchase commercial feeds when the prices are specially high as has been the case for two years. This is especially true when low prices are realized for the output from the herd. On the other hand, if a dairyman is selling his products at generous prices because of particular business relations or conditions, he can better afford to buy freely of commercial feeds. It is safe to assert, nevertheless, that farmers have depended too fully upon purchased materials and have not developed home resources as a means of feeding a herd of cows.

HOME-RAISED RATIONS VS. PURCHASED FEEDS

Several experiment stations have compared rations that are possible from home-raised materials with rations compounded largely by the use of purchased grains. The results reached in New Jersey are typical. In 1901 a ration composed of silage, alfalfa hay, a little mixed hay and two pounds of cotton-seed meal was compared with a ration containing an equal amount of silage and mixed hay and ten pounds of grain, eight of which were put in place of the eleven pounds of alfalfa hay. The production during four periods covering two months was practically the same with the two rations, four cows being used in the test. In 1902 a comparison was made between a ration containing cow pea silage, crimson clover and six pounds of corn and cob meal with one containing the same amount of silage, five pounds of mixed hay, four pounds of dried brewers' grains and two and one-half pounds of cotton-seed meal. Again the production from the two rations was essentially the same. These experiments illustrate the possibility of securing good production from a herd of milch cows by the use of home-grown nitrogenous fodders with a moderate amount of home-grown grain. It is not advocated that the purchase of protein feeds be discarded, but that farmers turn their attention to a larger production of alfalfa, clover, peas and other leguminous crops with a view to diminishing the feed bill.

THE GRAIN FEEDS THAT IT IS WISE TO PURCHASE

Many brands of commercial feeds are offered to farmers. Some of them are standard feeds, that is, composed of a single material having a fairly uniform character and composition. These are cotton-seed meal, linseed meal, gluten meal, gluten feed, distillers' dried grains, dried brewers' grains, malt sprouts, hominy feed, the various brans and middlings from the milling of wheat and other grains, and the whole or ground cereal grains. A large number of compounded feeds are in the market, selling for nearly as much as the standard feeds. These are to be regarded with suspicion, because so many of them contain ingredients inferior to the grains — such as oat hulls, ground corn-cobs, mill sweepings, weed seeds, ground hay or other fibrous materials. These low-value substances are more or less disguised by high-grade ingredients. These various compounded feeds are usually designated by proprietary names and they should be carefully examined before purchasing. The statements of sales agents should be verified.

The various patent foods advertised to have wonderful nutritive and medicinal properties should be severely let alone. They are an imposition on the farmers' pocketbooks.

Farm Poultry Management

By JAMES E. RICE

Professor of Poultry Husbandry, New York State College of Agriculture at Cornell University

The essentials to success with poultry fall naturally under five heads:

1. The breed and the breeding.
2. The feed and the feeding.
3. The hatching and the rearing.
4. The housing and pasturing.
5. The marketing of the products.

I shall be unable to discuss all of these features of successful poultry raising as applied to farm conditions in one general lecture. The time has come when one address can be spent better by concentrating on one of these five, rather than by undertaking to cover in an unsatisfactory manner all five features of the work. What I shall say this afternoon has to do primarily with one pivotal factor of the business that has not been fully emphasized; certainly never as vigorously as it should have been. This factor has to do with every phase of the keeping of poultry — the breeding, the feeding, the housing and rearing. All other factors hinge on this, namely, constitutional vigor.

My subject, therefore, is the constitutional vigor and vitality of poultry as applied to the hatching quality of the egg, the vigor of the chick and the mature fowl; all of which may mean success or failure to the person who engages in the business, depending upon the amount of skill and care shown in the selection of eggs, chicks and breeding stock, type of poultry house, and the nature of the rations, with the purpose of securing in the stock higher constitutional vigor.

THE HEALTH OF THE FOWL IS OF MORE IMPORTANCE THAN PEDIGREE

During all these years of advancement in poultry husbandry, we have heard much about the importance of choosing this breed or that breed for exhibition, laying or meat qualities. Comparatively

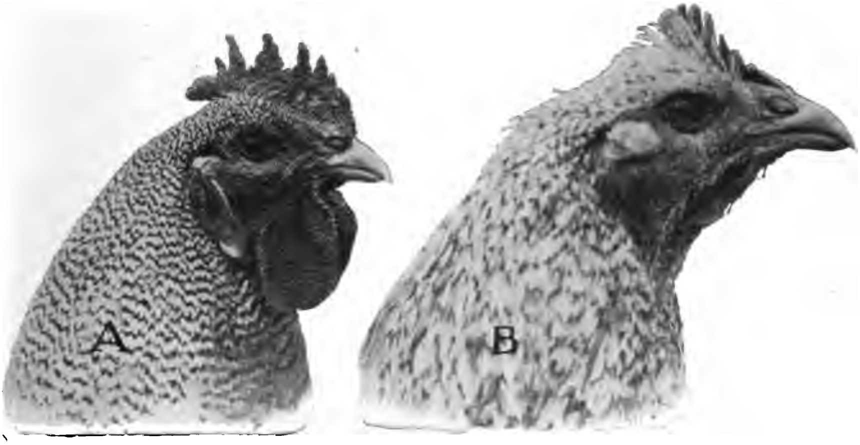

FIG. 2.— A. HEAD OF BARRED PLYMOUTH ROCK MALE SHOWING SEXUAL VIGOR AND MASCULINE QUALITIES. B. HEAD OF BARRED PLYMOUTH ROCK CAPON (UNSEXED MALE) SHOWING CHARACTERISTIC EFFEMINACY.

Note small comb and wattles and elongated beak.

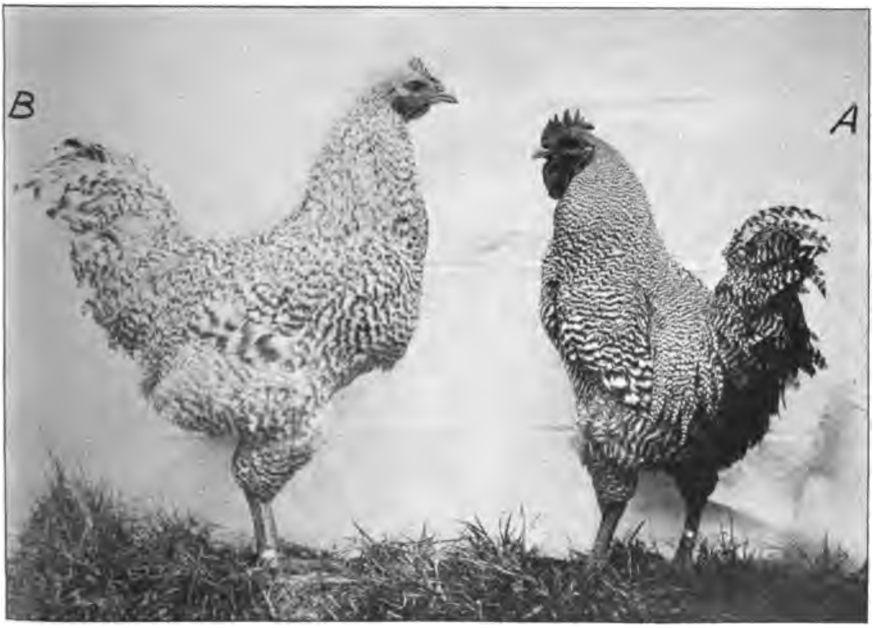

FIG. 3.— A. A FINE SPECIMEN OF A PHYSICALLY AND SEXUALLY STRONG MALE. Observe the alert attitude, expression, and brilliant plumage as compared with B, the sexless male, a large, clumsy, inactive individual.

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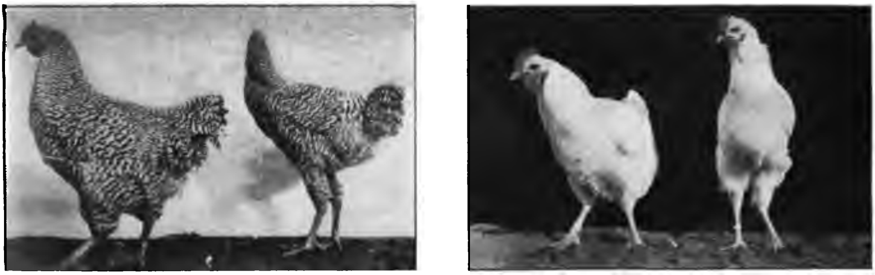
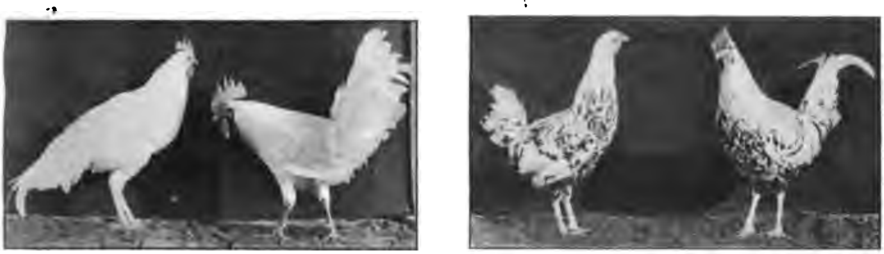


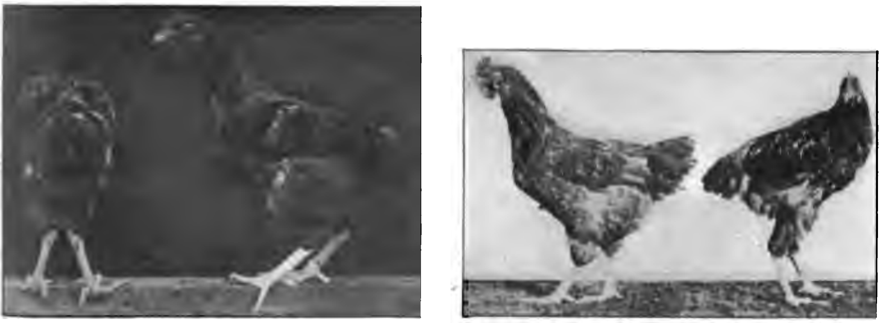
Strong. Weak.
A. Barred Plymouth Rock.

Strong. Weak.
B. White Plymouth Rock.



Weak. Strong.
C. White Leghorn.

Weak. Strong.
D. Silver Spangled Hamburg.



Weak. Strong.
E. Buff Plymouth Rock.

Strong. Weak.
F. Buff Orpington.

FIG. 4.— A, B, C, D, E AND F. TO SHOW CONTRAST IN CONSTITUTIONAL VIGOR IN COCKERELS OF SIX VARIETIES.

little emphasis has been laid on the importance of strength and vitality of the strain and individual as affecting these qualities. Our experiments at Cornell furnish conclusive evidence that there is more difference between the constitutional vigor and productiveness of certain individuals of the same strain than there are differences between breeds, as a whole, and practical experience indicates that this is equally true as between different strains of the same variety; hence it is unfair to condemn any breed, variety or strain on one trial. We have good reason for believing, also, that there are greater differences between different strains of a breed that has been bred for vigor, as compared to other strains of the same variety that have been improperly handled and bred, than there is between the different breeds under normal conditions. In other words, the pedigree of an individual or its high scoring qualities or its record as a producer is of less account from a commercial standpoint, although of great importance, than is the record of its good health, its ability to stand up under heavy feeding and high production, and at the same time to produce offspring possessing as strong qualities of health and productiveness as its parents did. "What profiteth it" if we gain high production, and lose health in succeeding generations? In other words, we must emphasize not less the importance of having pure breeds, but emphasize more the greater importance of having *strong* pure breeds.

HOW FOWLS OF STRONG CONSTITUTION DIFFER FROM FOWLS OF WEAK VITALITY

In view of the above and the experiments made at Cornell, we are now justified in saying that there are physical differences that distinguish the weak from the strong fowl, and that any person who has given the subject close consideration and who has studied fowls carefully cannot help but discover that there are physical resemblances and physical differences that distinguish the strong animal from the weak. This is true, whether we are considering a very young chick, a half-grown chick or a mature fowl.

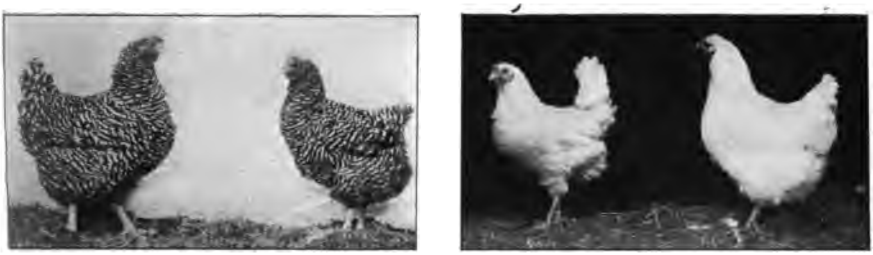
In view of the importance of constitutional vigor, it becomes necessary to ascertain the physical differences which exist and how to recognize them. It is necessary now to answer the question whether a constitutionally vigorous fowl may be distinguished from a constitutionally weak fowl, and if so what are the distinguishing characters and how may they be recognized.

In our experiments at Cornell we have been selecting males and females according to the vigor wholly by their physical characters as we have been able to observe them from day to day. A few of these distinguishing characters will be shown in various photographic enlargements of strong and weak fowls of the same sex and vitality. This morning I spent an hour with one of our classes at the poultry plant, handling fowls of high and low vitality. We had both strong and weak Plymouth Rock cockerels and strong and weak Orpington cockerels. Any student in the class, after one hour's study, could, I am sure, pick out the strong from the weak individuals, wholly by comparing their external differences.

The Farmers' Institute could well afford the expense of shipping from one meeting-place to another coops of fowls showing both the strong and the weak individuals of different breeds. These would be living examples of the right and the wrong sex types that should be bred or discarded. There is no way in which persons can so quickly and firmly fix in the mind the types which represent differences in constitutional vigor as to study the fowls themselves.

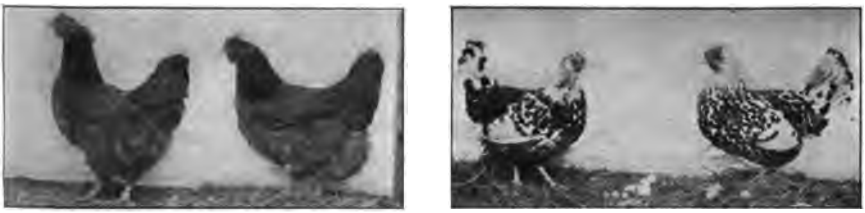
One of the strong characteristics of the vigorous fowl (male) is his crow. The two strong males above mentioned crowed during most of the lecture, while the weak ones did not make a sound. The voice is quite as important a sex character in indicating the strong female as it is the male.

The actions of a fowl indicate its physical vigor and it is one of the best ways of selecting the weak from the strong. Recently in an experiment to determine the importance of constitutional vigor, I had occasion to pass several times during the day two flocks of hens. One pen contained twenty-five hens of low vitality, the other, twenty-five fowls of the same breed and age of strong vitality. The stronger fowls were found busily working in the litter, while the weaker ones were, for the most part, squatted on the floor or upon the perches, inactive. A fowl that does not



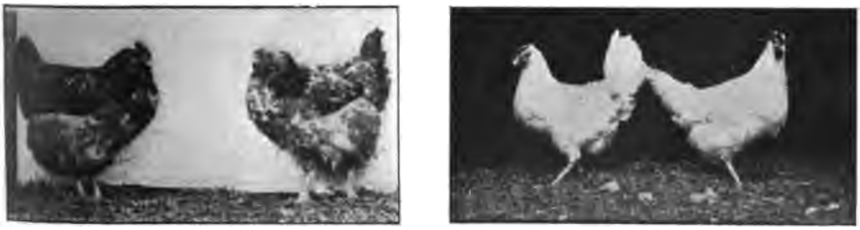
Strong. Weak.
A. Barred Plymouth Rock.

Weak. Strong.
B. White Wyandotte.



Weak. Strong.
C. Buff Orpington.

Weak. Strong.
D. Silver Spangled Hamburg.



Strong. Weak.
E. Rhode Island Red.

Weak. Strong.
F. White Leghorn.

Fig. 5.— A, B, C. D, E and F. To Show Contrast in Constitutional Vigor in Females of Six Varieties of Fowls.

The differences are much more apparent when comparing the live fowls. The photograph fails to show clearly the brilliancy of the plumage and to catch the natural attitude and expression of the fowl.

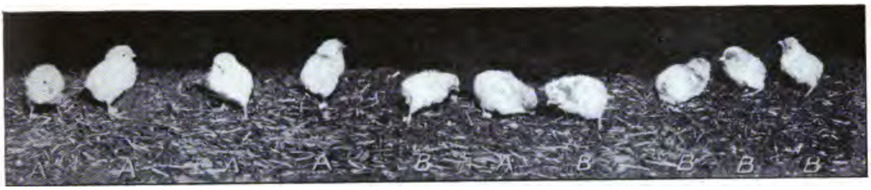


FIG. 6.— BABY CHICKS JUST REMOVED FROM THE INCUBATOR.
Note the difference in size, shape, and attitude of the body between A and B.

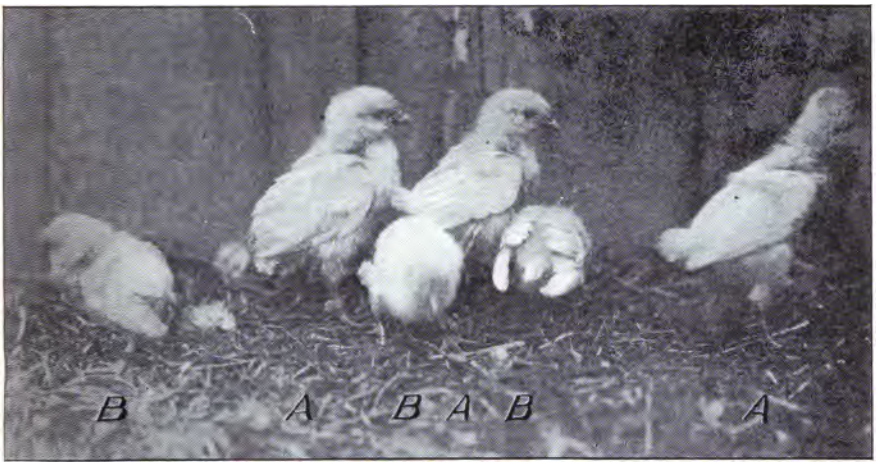


FIG. 7.— CHICKS 10 DAYS OLD.
Observe that in Group A the chicks are of larger size with better developed wings and tail and with feathers close to the body, as compared with Group B.

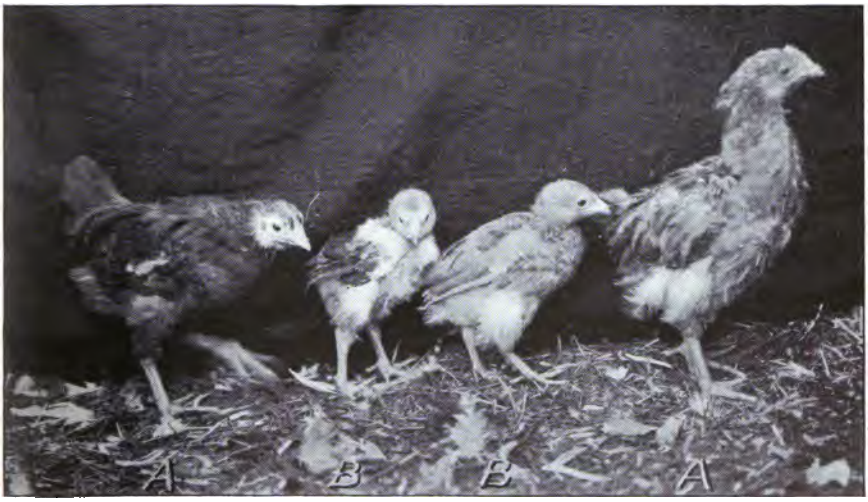


FIG. 8.— FOUR CHICKENS OF THE SAME VARIETY, AGE, AND METHOD OF REARING.
The difference in size is apparently due to an inherited weakness.

feel strong will do precisely what a human being will do, namely, rest; they will go to bed early and get up late and also, perhaps, go to bed during the day. The activity of the fowl is one of the best ways, also, of selecting hens that are laying from those that are not, particularly when observation is made just before their going to roost at night. At this time the laying hens, because they are consuming more feed and have better appetites, are more likely to be hunting for grain in the litter or are out in the fields foraging in order that they may go to roost with their crops filled, so that they may supply the demands of the body for nourishment which they digest and assimilate during the night. The fowl that is not laying has less appetite for food and, therefore, is more easily satisfied and more likely to go to bed earlier with the crop only partly filled.

The shape of the body of a fowl is a valuable indication of its strength. There seems to be a correlation between the body shape and the body health. Fowls of low vitality appear to develop bodies that are long and slender as compared to the shorter jointed, broader backed, stocky individuals (Figs. 4 and 14). There is a correlation in the shape of the different sections of a fowl. For instance, a long, thin beak is associated with a long, thin head; long, thin neck; long, slender body; long, thin shanks and toes. These loose-jointed, long, slender types generally have low vitality (Figs. 4, 8B, 9 and 14B).

Beginning at the head, we will observe in detail the various characters which indicate high or low vitality. The head of a fowl having high vitality is likely to be short and thick, well-rounded and symmetrical, with a short, heavy, curved beak as compared to the fowl having a weak constitution, which generally has a long, thin, flat beak and head. This has given rise to the term "crow-head," which is an indication of weakness in the domestic fowl (Fig. 9).

The comb is an excellent indication of physical strength. Large, bright red combs indicate good circulation of blood and strong constitution. It can be said that the hen carries her health certificate on top of her head (Figs. 2, 4, 5, 13 and 14).

The eye has been called the mirror of the mind. It may, with equal propriety, be called the mirror of the health of the fowl.

A bright, full, round eye indicates good health and strong constitution; a dull, sunken eye, with drooping lids, is an almost infallible indication of low vitality (Figs. 7, 8 and 9).

The back of the fowl of strong constitution should be broad, the body should be deep. Both points indicate large capacity for digesting and assimilating food (Figs. 3, 4, 5, 13 and 14).

The tail, also, may be used as an indication of constitutional vigor. The fowl of strong vitality carries the tail in its normal position. The fowl having low vitality is likely to carry the tail to one side or allow it to droop, because the muscles of the tail are weak. This is particularly true when the weak fowl is in the presence of a strong fowl (Fig. 4). A fowl, when frightened, usually drops the tail. This, therefore, is an indication of weakness. Fear and physical weakness are very closely associated. The way the young chick carries its tail feathers indicates its physical strength (Fig. 7). When the little chick carries its tail feathers erect, we may be pretty certain that it is in good health.

The brilliancy of the plumage may also be used as a character to indicate vigor. Fowls in perfect health have an abundant supply of oil in the oil glands. Oil is fat and fat is stored up energy. Only fowls having strong constitutions have surplus energy, therefore, weak fowls would not have a supply of oil with which to oil the plumage. It then becomes dull and lusterless (Figs. 3, 4, 13 and 14).

The shanks of a fowl show clearly its physical condition. Fowls having shrunken, faded out shanks surely lack vitality. Fowls and chicks of strong constitution have large, plump, normally colored shanks (Figs. 3, 4, 5, 9 and 14). It is for this reason that the color of the shanks of a hen that has laid a very large number of eggs will be lighter colored than those that have not been productive, other things being equal. It is a well-known fact that the breeds having yellow shanks will have laid the color out of their shanks toward the close of the laying season. The width between the shanks indicates the width of the body, therefore, it is a valuable point to be considered in selecting fowls according to their vigor. Almost invariably fowls that are narrow between the shanks have low vitality (Figs. 4, 7, 9, 13 and 14).

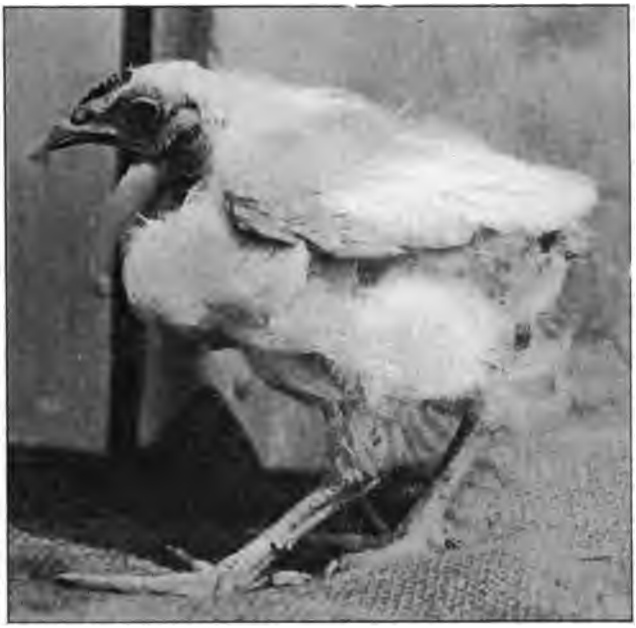


FIG. 9.— AN EXTREME CASE OF LOW VITALITY RESULTING IN SLOW FEATHERING AND IRREGULAR DEVELOPMENT.

Notice also the "crow-head."

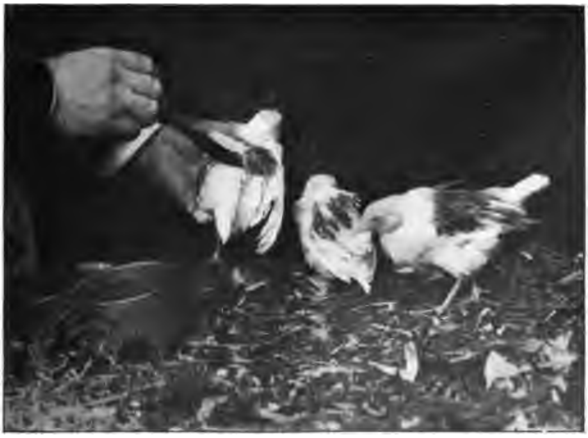


FIG. 10.— METHOD OF STAINING CHICKENS WITH A BRILLIANTLY COLORED ANILINE DYE.

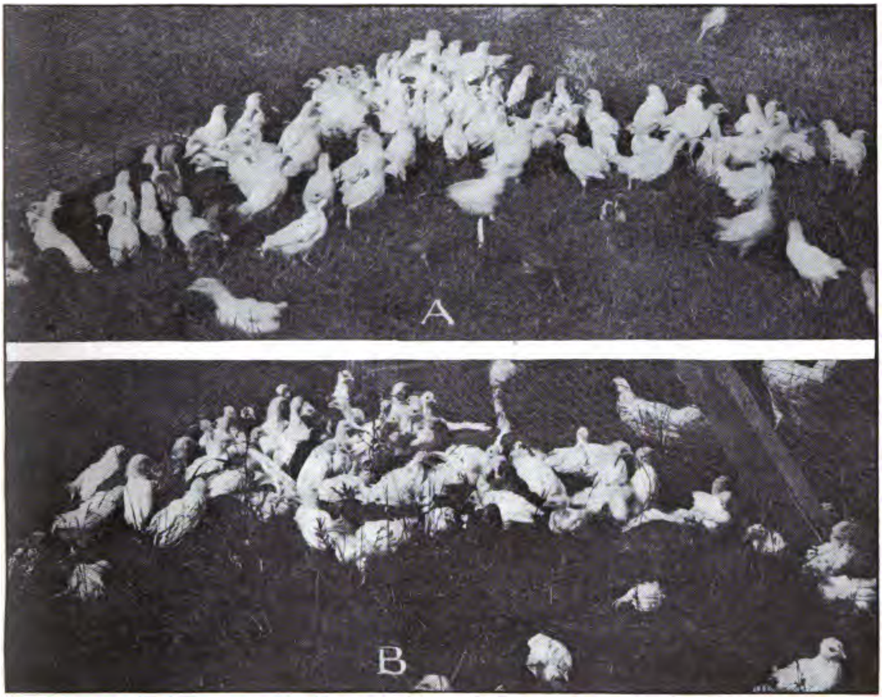


FIG. 11.— TWO FLOCKS OF LEGHORN CHICKENS GRADED ACCORDING TO THEIR CONSTITUTIONAL VIGOR. GROUP A, STRONG; GROUP B, WEAK.

Some of the same chickens at a later age are shown in Figure 12.

The above are a few points which may be used to recognize high from low vitality in selecting fowls for the breeding pen.

SEPARATE THE WEAK FROM THE STRONG

It is a principle of general application that weak individuals should never be allowed to run in the same flock with the strong. They cannot survive in competition with more vigorous stock. Whereas, if the weak were in flocks by themselves they would be on an equal footing and would make much more satisfactory development. Therefore, chickens should be marked so as to be quickly detected if they should become mixed with the others (Fig. 10).

WHAT WE ARE ASKING OF THE DOMESTIC FOWL

It must be apparent to all who are familiar with the breeding of the domestic fowl that we are assuming a great responsibility in our endeavor to increase productiveness and at the same time breed fowls of strong constitution. We ask the hen to reproduce herself 150 to 200 times a year, or, in other words, do what in effect is giving birth to offspring almost every other day during the year. We had one hen that laid 213 eggs in ten months. This was about five times her own weight. It is important to consider where we are going to stop forcing the fowls to higher and higher egg yields by methods of selecting for high producing power, coupled with stimulating, forced methods of feeding. Some indications would lead us to suspect we have carried the matter too far already for the good of the succeeding generations. Recent observations in hatching and rearing chicks from heavy laying hens, where the chicks have been leg-banded, indicate that eggs laid by high producing individuals at the latter end of their producing period are likely to be less vigorous. By the time a hen has laid 200 to 250 eggs she is likely to become weakened, broken in constitution and finally a physical wreck.

To emphasize the tremendous digestive and reproductive power of the modern domestic fowl, we quote from Dr. W. H. Jordan, of the New York Experiment Station at Geneva, who, for illustration, has compared a Leghorn fowl that weighs three and one-half pounds and lays 200 eggs, weighing twenty-five pounds, with a Jersey cow that weighs 1,000 pounds and gives in a year 7,000 pounds of milk containing fourteen per cent. of solids. He states: "If you take the dry matter of the hen and compare it with the dry matter in the eggs she lays in a year, there will be five and one-half times as much dry matter in the eggs as in her whole body. The weight of the dry matter in the cow's body to the weight of the dry matter in the milk will be as one to two and nine-tenths. In other words, based upon the dry matter, the hen does twice as well as the cow. I suspect the hen is the most efficient transformer of raw material into a finished product that there is on the farm. Her physiological activity is something remarkable. So in that particular, the hen stands in a class by herself."

WHAT WE MAY DO TO INCREASE CONSTITUTIONAL VIGOR

How then are we going to secure large egg yields and, at the same time, produce eggs that will hatch strong stock? There are many things we may do by way of selection with the object in view of building up constitutional vigor and keeping it after we get it, any one of which, alone, will not accomplish the purpose, but all taken together will result in developing a strain of vigorous stock.

1. *Breed only good, vigorous stock.* The regular mating of high producing individuals possessing good, strong constitutional vigor, selected in conformation with the principles here discussed, is the only alternative.

2. *Select good, normal eggs for hatching.* Only eggs of uniform size with good, strong shells should be used. Any weakness or deformity in the shell indicates corresponding deficiency in the contents of the egg and the vitality of the germ. This is more particularly true where the shell is spotted or weak.

3. *Eggs for hatching should be kept under proper conditions.* The way the eggs are kept may have a large influence on the percentage of the chickens hatched. In two experiments tried at Cornell with a thousand or more eggs, testing various methods of holding eggs for incubation, we have found that eggs lose rapidly in hatching power when they are kept under unfavorable conditions. It has been found that eggs should be kept in a temperature of forty-five to fifty degrees, turned regularly each day, and

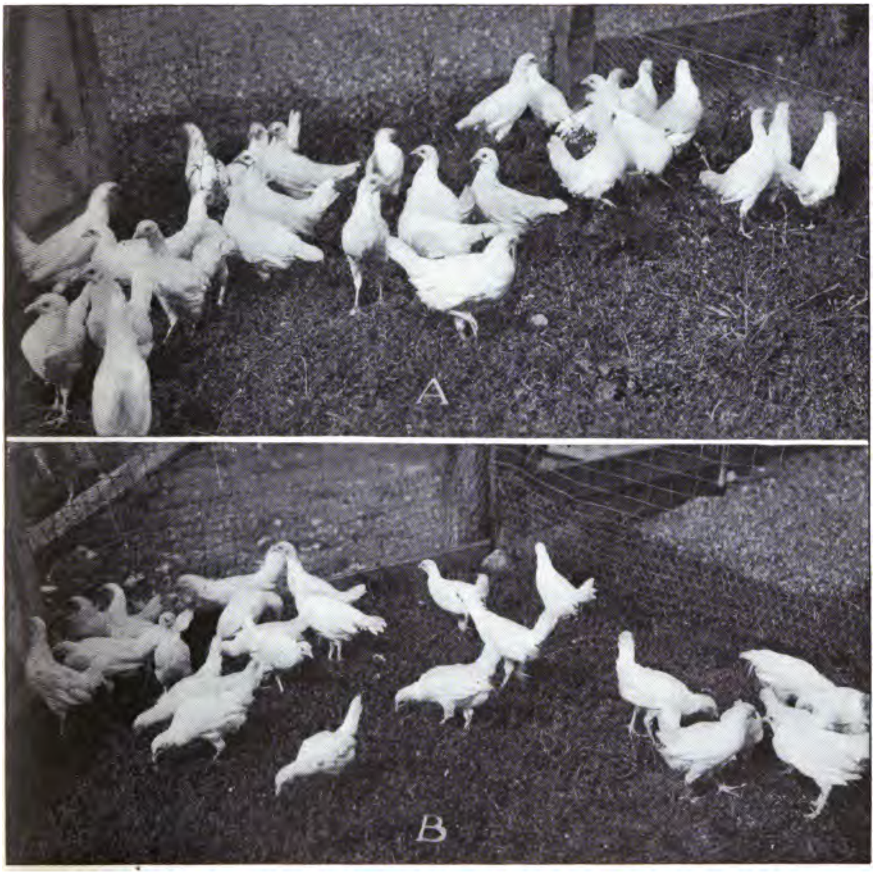


FIG. 12.—STRONG AND WEAK WHITE LEGHORN CHICKENS WHEN THEY HAVE COMPLETED THEIR FIRST CHICK PLUMAGE. GROUP A, STRONG; GROUP B, WEAK.

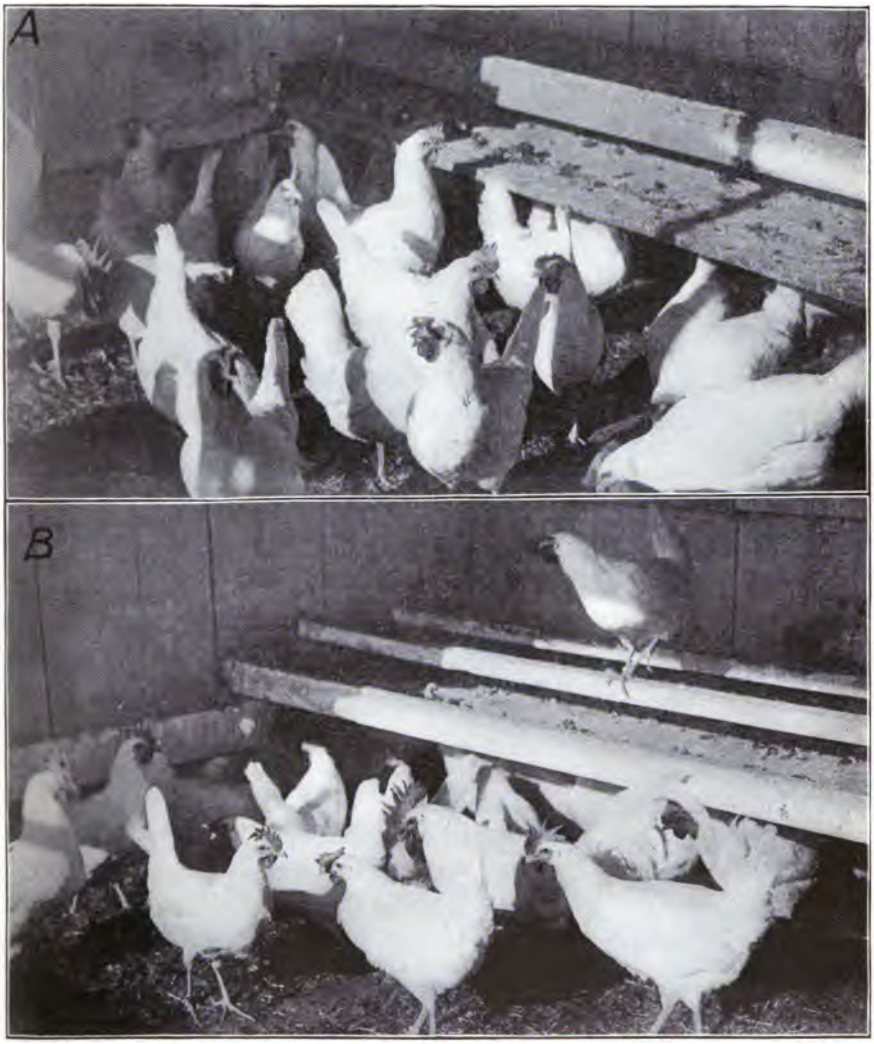


FIG. 13.— THE TWO FLOCKS OF FALL SELECTED PULLETS USED IN EXPERIMENT NO. 2.

Photograph taken soon after they were placed in winter quarters. Group A, strong; Group B, weak. Note the difference in type of body, size of comb, shape of head, etc. From these two pens were hatched the pullets shown in Figure 14.

should not be kept longer than two weeks if it can be avoided. To prevent evaporation from the eggs, they should be kept covered or in a case where the air cannot pass over them. It was found in the experiment above named that the fertility and hatching power of the eggs were practically ruined by keeping them in a living-room temperature for two or three weeks. This is because the life germ begins to develop at a temperature as low as seventy degrees, which is considered the usual temperature of a living room. What then must happen to eggs that are kept in the country grocery store for days at a time, where frequently the mercury touches ninety degrees in the shade or higher? We can readily see why unfertilized eggs are more valuable, especially for placing in cold storage during hot weather.

How important it is, therefore, that we should not lose by faulty methods of handling eggs the constitutional vigor which we have succeeded in developing in the egg by careful selection of the breeding stock and the handling of fowls.

4. *Eggs must be properly incubated.* It is claimed by many that hen-hatched chickens will "stand up" many weeks longer when subjected to the strain of continuous exhibition at the poultry shows than will the incubator-hatched chickens. For this reason many poultrymen put their best eggs under hens to hatch for breeding and exhibition. This conclusion may or may not be true, however, but due to improper methods of operating the machine or the use of a poor incubator. It appears justifiable to say (the opinion based entirely on observation rather than experiment) that where incubators are run under favorable conditions, the loss of vitality by artificial methods of incubation is so slight that in a period of ten or twelve years weakened conditions are not apparent. It is possible, however, that failure to notice any decline in constitutional vigor is due to the fact that great care has been used in the selection of vigorous stock for breeders and that hens instead of pullets have been used for breeding purposes, and only good eggs, weighing at least two ounces or more, have been used for hatching. A good incubator in the hands of a poor operator or a poor machine in the hands of a good operator will in every case be likely to hatch chickens that are inferior to those hatched by hens. But we also have good reason to believe that a

good incubator handled by a good operator will hatch chickens nearly equal to the hen-hatched, and that no ill effects are to be observed even where continued for many years, the stock being kept and chickens reared, of course, under favorable conditions.

5. *Select chickens for constitutional vigor when they are hatched.* The day that the chick hatches is the best time to make the first selection. Weakness will usually show in the lateness of hatching and appearance of the baby chick — lack of fatness in the body and shanks, sunken eye, pale beak, peevish voice, low mentality, inactivity and shortness of the down (Fig. 6). Chicks showing weakness should be killed when removed from the incubator. While many of these chicks might live to reach maturity, they are the ones that are most likley to die after we have been to the expense of rearing them.

6. *Whenever a weak chicken appears, remove it.* Weakness is most likely to show about the time the chick is one week old, when the food supply in the yolk sac has disappeared and the chick must depend largely upon the food consumed. Again, weakness will show when the chicks are first feathering. (Figs. 7 and 8.) If chicks develop weakness when they reach the feathering stage, they should be marked (Fig. 10) and separated from the rest and fed for market.

Among the chickens of the same age and breed, those which feather more quickly are usually more vigorous (Figs. 7, 8 and 9). The growth of the feathers is a good indication of vigor. Those which are slow to feather, therefore, should be marked and separated from the others and sold for market. While it is not profitable to keep to maturity chickens of low vitality, we have found that when placed in flocks by themselves the low-vitality chickens will gradually improve and sometimes almost completely recover, if fed a ration consisting of equal parts of finely ground corn, ground buckwheat (shucks removed) and ground oats, mixed with sour skimmed milk or buttermilk and fed in semi-liquid form. This method of feeding should not be continued for more than two or three weeks. The chickens can then be sold as squab broilers.

7. *Select strong cockerels during the growing season and again cull these when they have reached maturity in the fall of the*

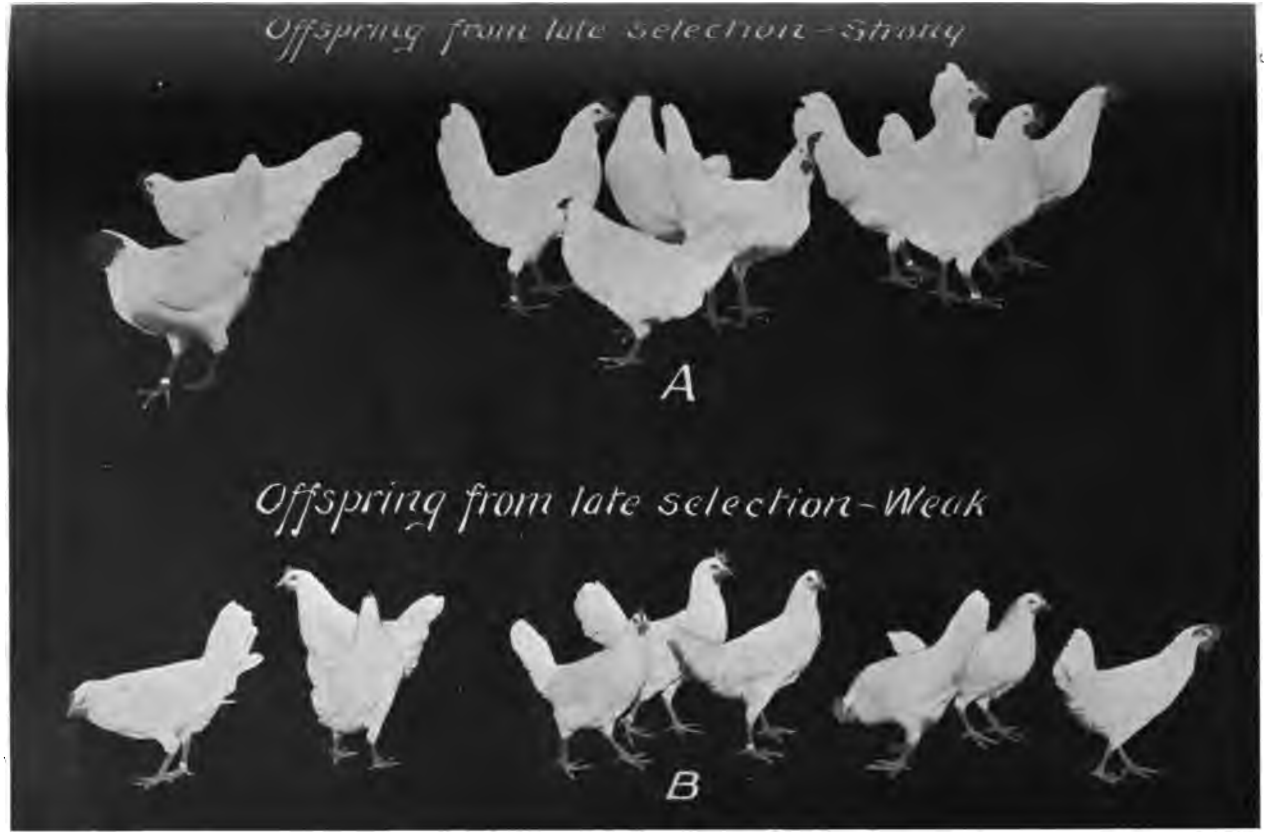

Offspring from late selection-Strong
A
Offspring from late selection-Weak
B

Fig. 14.—Pullets in Group A Were Hatched from the Flock Shown in Figure 13, A (Strong). Pullets in Group B were Hatched from Hens Shown in Figure 13, B (Weak). Pullets in Group A averaged in weight over one-half pound more than those in Group B. All were hatched at the same time, in the same machine, legbanded, and brooded, fed and allowed to run together on free range during the summer. Observe the differences in type of body, size of comb, etc.

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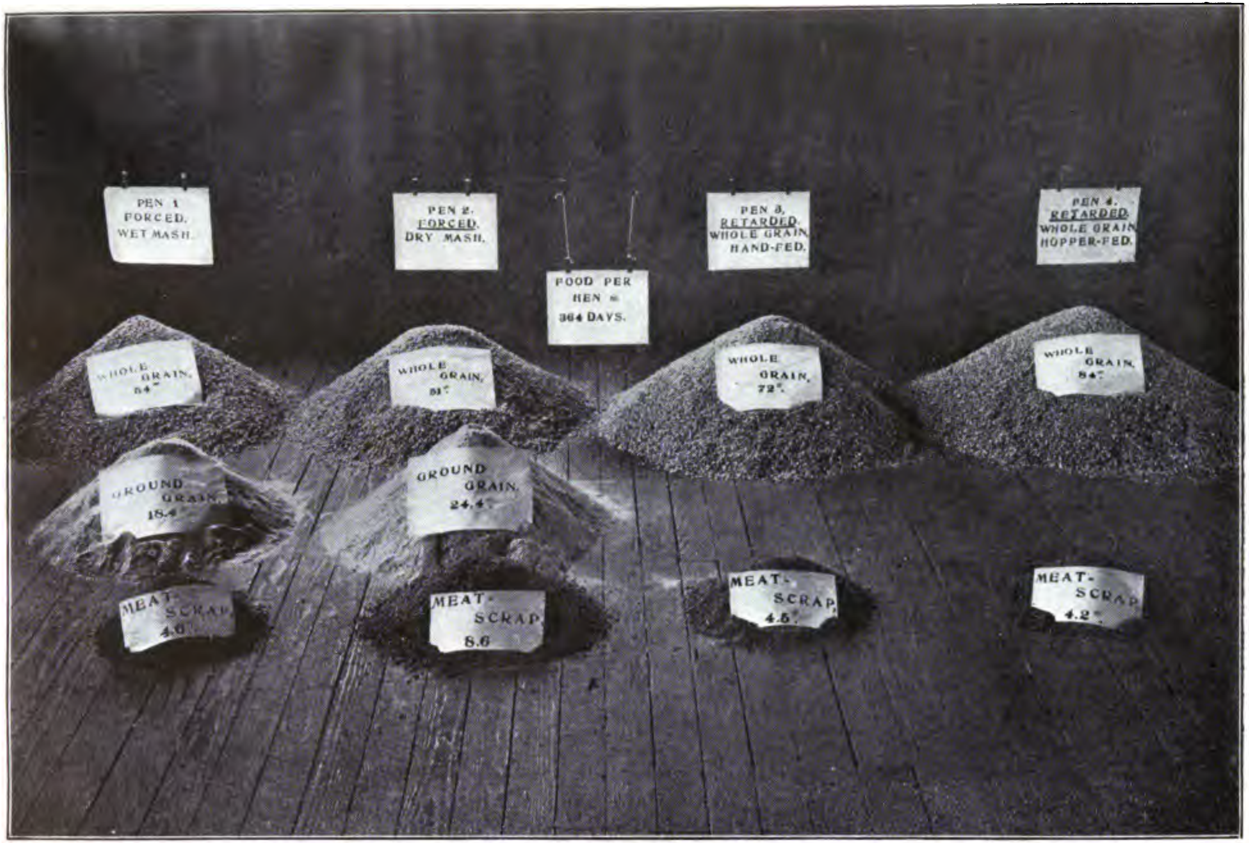

FIG. 15.— FEED CONSUMED IN A YEAR BY FOUR FLOCKS OF PULLETS.

year. Usually a very large number of cockerels are hatched and only a few need to be kept for breeders. On the farm these can best be allowed to run with the pullets, but where large numbers are reared, it is better to have a separate house and field for the cockerels. The sexes should be separated as soon as the cockerels begin to crow; that is, when the comb becomes slightly developed so as to unmistakably indicate the sex. The same rule for selecting strong cockerels applies to selecting pullets, except that a much larger proportion of pullets must be saved.

8. *Select the fowls for constitutional vigor during their molting period.* Fowls that are weak usually molt late and are unable to molt properly or are very slow to renew the coat. Fowls that are of low vitality and not fat usually are unable to shed their feathers. It becomes important, therefore, to distinguish between the conditions causing the late molting of fowls. It was found in our molting experiments that the best laying hens, as a rule, were the ones to molt late. Hen No. 61 laid 213 eggs in ten months and did not molt until the middle of November, when she was nearly featherless.

9. *Feed fowls properly and do not starve them during the molting season.* We can now say with considerable certainty that it will not pay to starve fowls with the expectation of forcing an early molt in order to secure large winter egg yields. Our experiments indicate that the starvation process will injure the fowls to the extent of decreasing their total egg yield. In three experiments, published in Cornell Bulletin No. 258, we starved three flocks of fowls for four weeks and compared the results with three flocks of fowls of the same age and variety that were well fed during the molting season. We made twenty-five cents more per year from each of the 120 hens that were well fed than we did from 120 that we starved. Our final conclusion is that it is good business to let a hen lay when she wants to lay and a poor practice to stop her from laying when she would lay in the summertime, and then take our chances of starting her again.

10. *Feed breeding hens liberally and keep them busy.* We have all heard it said that if you feed a hen too liberally she will become too fat and will not lay well. This may be true in rare instances, but we now know positively that unless a hen is given what she

wants to eat she will not lay many eggs. Figure 15 shows the kind and amount of feed consumed in a year by four flocks of pullets. The results of this experiment were published in Cornell Bulletin No. 249.

A hen must have some fat in her body to be in the best laying condition. To accomplish this without making the fowl over fat, we must feed a ration that is properly compounded; that is, it should contain grain, ground feed, meat and vegetable food, and allow the hen to have all she wants to eat of the grain at least once, and preferably twice a day, with meat scraps and ground grain in a hopper where she can help herself at all times. The grain should be fed in a litter morning and night where the hens will be required to work for what they get. Exercise appears to be necessary for the best results. Activity results in keeping the animal in better health.

The illustration here shown (Fig. 16) is only one of a large number of observations which we have made in studying the physical condition of the fowl as affecting her production. The six fowls shown in the illustration were selected from a large number of Barred Plymouth Rock hens. When they were opened and examined it was observed that in almost every instance fowls that were the fattest were in the best laying condition; that is to say, eggs were found in their bodies in various advanced stages of development. Whereas in the fowls that were lean or only slightly fat, the egg organs were dormant or practically so. In order to show the relation of fatness to egg production, the three fattest hens and the three leanest hens were opened and placed in groups as shown. The three fattest are on the left and the three leanest on the right, the egg organs being shown below the fowl from which they were removed.

There is a very good explanation of the reason why the hen must have surplus fat in her body in order to lay. This lies in the fact that the yolk of the egg is the first part to be formed and that 64 per cent. of the dry matter is fat. It must be apparent, therefore, that the first part of the egg, the ovule, must be developed largely from surplus fat in the body. Only the surplus energy of the fowl will be stored in the body in the form of fat, hence it is that only those fowls that have surplus energy in the form of

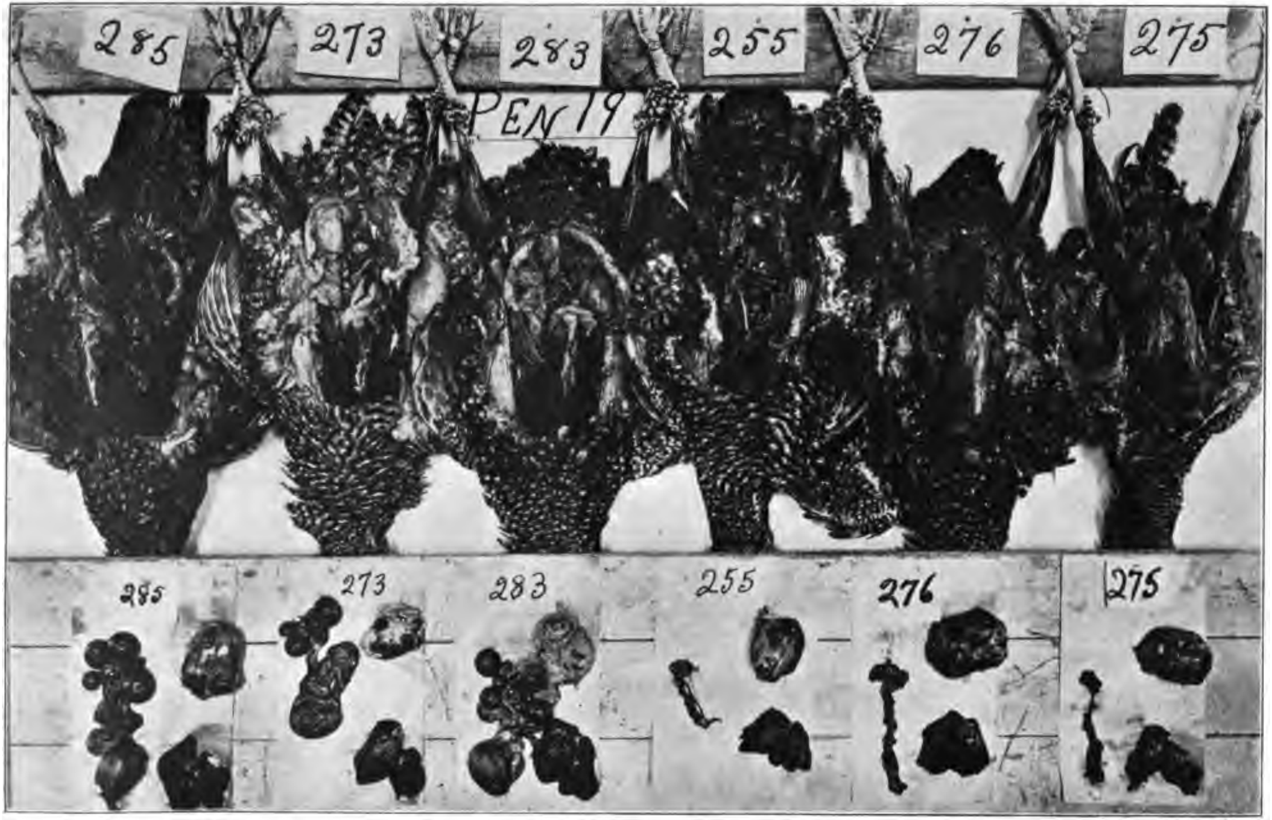

FIG. 16.— SHOWING THE RELATION OF FATNESS TO EGG PRODUCTION.

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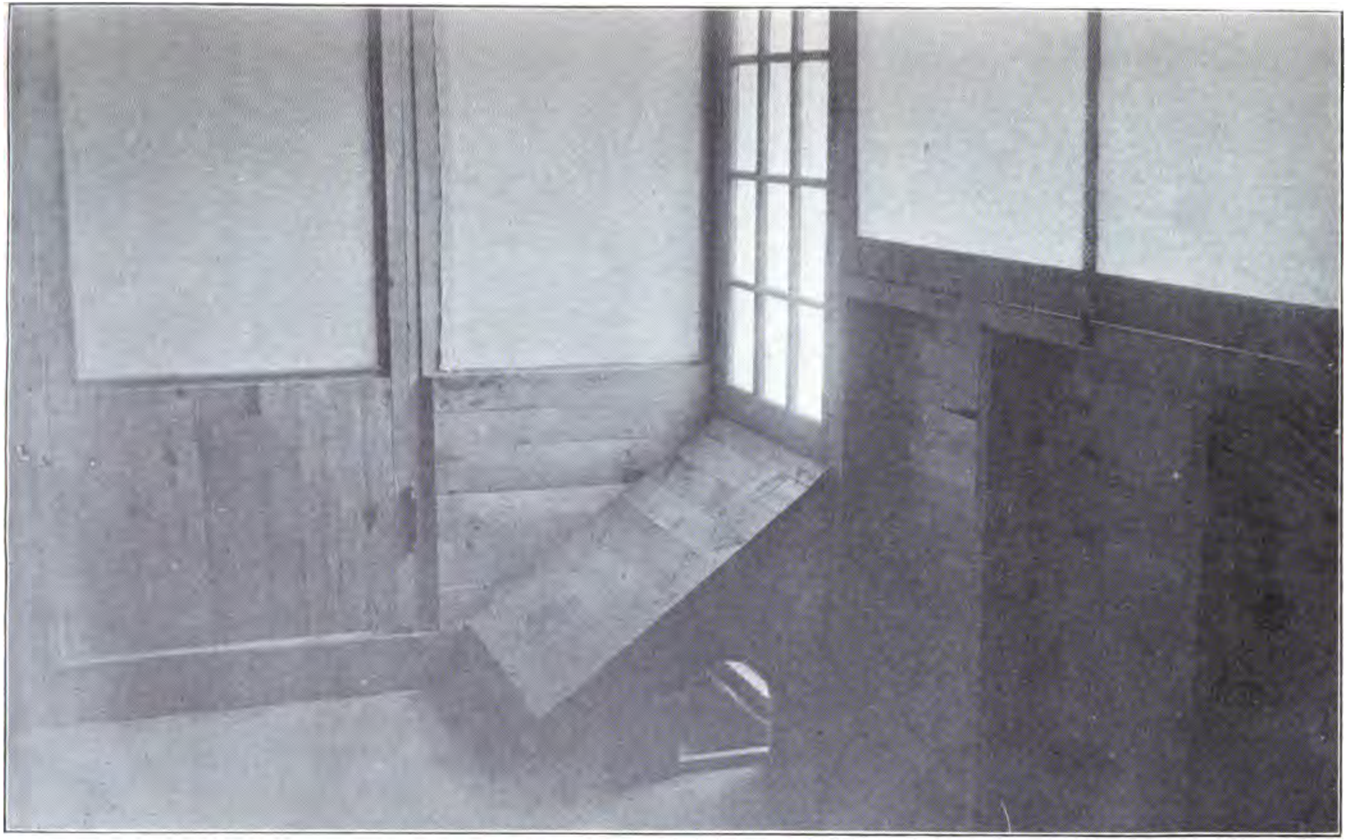


Fig. 17.— Fresh-air Type of Poultry House showing Dust Wallow.

fat can develop the ovule. Moreover, we have good reason to believe that in fowls which have developed ovules to the mature state, ready to form eggs, the ovules may be reabsorbed through injury, starvation or sickness. We therefore see the importance of giving the right kind of feed and care so that fowls may continue to develop the ovules normally from the surplus fat and also of avoiding irregularity and improper feeding, which may prevent the fowls from developing the ovules and thus be unproductive.

11. *A healthful poultry house is a necessity in maintaining constitutional vigor.* Hens must have pure air if they are to have pure blood. The best poultry house for good production in this State should be of the fresh-air type; tight on all sides, including floor and roof, except the front, which should be about one-sixth glass and one-sixth loose cloth for a pen twelve feet square, and more in proportion for a deep house fifteen, eighteen, twenty, or more, feet deep. The house should be as low as possible to reduce the air space and still enable the attendant to do the work conveniently. In this State double boarding is unnecessary, except back of and above the roosting compartment, and this should not form a dead-air space, but should be open to enable the air to pass freely between the rafters and the side. By this method the double boarding keeps the rest of the compartment warm and dry.

Fowls to keep in good health must be kept free from lice. This can best be accomplished by means of a dust wallow. Figure 17 shows a good location for the dust wallow on the floor near a window and covered to prevent the dust entering the room.

RESULTS OF EXPERIMENTS

In order to determine the actual profit or loss in keeping fowls of low vitality as compared with those of high vitality, three flocks have been compared. The results are shown in the table below. Twenty-five hens were kept in each flock with two males. Two experiments were with Leghorns and one with Barred Plymouth Rocks. Each experiment compared twenty-five strong hens with twenty-five weak ones. The fowls were selected as strong or weak wholly by their appearance and actions, as indicated in the illustrations already discussed. In one experiment the selection was

TABLE No. 1 — SHOWING FINANCIAL STATEMENT PER HEN BASIS.

	White Leghorn, spring selection Strong	White Leghorn, spring selection Weak	White Leghorn, fall selection Strong	White Leghorn, fall selection Weak	Barred Plymouth Rock, fall selection Strong	Barred Plymouth Rock, fall selection Weak	Average strong flocks	Average weak flocks	Difference
	Pen 78	Pen 79	Pen 76	Pen 75	Pen 8	Pen 10	Pens 8, 76, 78	Pens 10, 75, 79	
Number of eggs per hen	128.5	131.4	120.4	92.7	125.4	114.4	124.7	112.8	11.9
Value eggs per hen	$2.95	$3.05	$2.80	$1.95	$3.01	$2.74	$2.92	$2.58	$0.34
Balance profit per hen	$1.81	$1.63	$1.65	$0.74	$1.71	$1.57	$1.72	$1.32	$0.40
Per cent., mortality	0	16.	8.	28.	12.	8.	6.6	17.3	
Per cent., fertility	88.1	81.7	86.2	69.	78.8	69.6	85.1	75.9	9.2
Per cent. hatching power	67.3	68.1	63.4	57.8	52.1	45.5	62.4	61.0	1.4
Average weight in pounds pullets saved	3.00	3.05	3.07	2.45	4.53	3.48	3.53	2.99	.54

made in the spring when the chickens were young; the other two were with fowls selected when the pullets were ready to go into winter quarters in the fall. Figures 4 A and C, 11, 12 and 13 show the flocks used in these experiments. From the columns of averages on the right of the table (page 86), where the production from the three flocks of strong vitality are averaged and compared with the average results from the three weak flocks, it will be seen that the strong flocks averaged about one dozen more eggs per hen, paid a profit over the cost of feed of forty cents more per hen, gave nine per cent. better fertility and one per cent. better hatching power to the eggs, and that pullets hatched from eggs laid by strong flocks weighed over one-half pound more per chicken in the fall than did the pullets hatched from eggs laid by weak flocks at the same time, in the same incubators and reared in the same brooders. In figure 14 are seen the pullets from hens of high and from hens of low vitality. Note the difference in size and shape of the body, size of comb and shanks of the pullets in the two flocks. The pullets from the strong vitality appeared to be at least four weeks older, although all were hatched at the same time, in the same incubator and brooded and fed together during the entire season. The results clearly show the importance of carefully and intelligently selecting the breeding stock for constitutional vigor.

DISCUSSION

Question.— Will Mico Spar Cubical Grit supply all the needs of the fowls for grit?

Professor Rice.— Presumably, yes, for grinding material but not for lime. Fowls, in order to lay the usual number of eggs, must have lime in some form in addition to the lime to be found in the best of rations. Cracked oyster shell is one of the cheapest and best ways of providing lime for the hens. Cracked limestone will answer the same purpose. It was shown in our experiments that fowls suffered in bodily strength when they lacked mineral nutrients, chiefly carbonate or phosphate of lime. This was indicated by the breaking strength of the bones. In one experiment where the fowls did not have sufficient lime in their food, the bones were tested and found to be deficient as compared to the strength of similar bones of fowls in normal condition. This would indicate that because the fowl lacks lime to make the egg shell or to nourish the bones, its bones may become weak because of a lack of lime to replenish the bone or because the lime of the bone has been used to make the egg. It is quite as important, therefore, that the cracked shell be fed as that the hens have sufficient grain, meat or vegetables.

Question.— Are hens to be preferred to pullets for breeding?

Professor Rice.— Yes, in almost every instance. Hens lay larger eggs, and it has been shown by Professor Horace Atwood, of the West Virginia Experiment Station, Morgantown, W. Va., that the weight of the egg influences the size of the chick. Moreover, hens do not lay as many eggs in the fall and winter as pullets. Therefore they are likely to be more vigorous during the breeding season than are the pullets that have laid continuously during the fall and winter. There are instances, undoubtedly, where good, large, vigorous early pullets may be quite as desirable for breeding purposes as hens of the same variety; however, hens are generally to be preferred.

Mr. M. R. Dawley.— Did you find eggs kept in cold storage best?

Professor Rice.— Yes, the eggs kept at forty-five to fifty degrees hatched the best.

Question.— Would you recommend farmers to band weak chickens?

Professor Rice.— No, it is better for a farmer to have a special brooder and yard on the ranch and let everything that is weak go there. Paint them red so they can be distinguished from the others.

Mr. Hall.— How large a percentage of chickens hatched will be weak?

Professor Rice.— Some hatches are almost all weak and others are almost all strong. The better the management and the selection and care of breeders, the better will be the net result. Ordinarily, with reasonably good care in feeding, breeding and housing stock, and with modern methods of rearing, not more than ten per cent. of the chicks would be "culled" out to be marked or destroyed.

Mr. Ward.— How often do you turn the eggs?

Professor Rice.— Every day or every other day will probably give best results.

Question.— Could you put them in egg crates and turn them over?

Professor Rice.— Yes, if done very carefully. Putting them on a perfectly smooth surface and shuffling them gives good results.

Mr. Van Wagenen.— Shall we advise the farmer to put them in the farm cellar for best temperature?

Professor Rice.— Yes, the bottom of a good, cool farm cellar with something over them to prevent evaporation provides a most satisfactory way for keeping the eggs.

Problems of the Milk Producer

By W. A. Stocking, Jr.
Professor of Dairy Industry, New York State College of Agriculture at Cornell University

I believe that we will all agree that there is a big problem before the milk producer, namely, the production of a higher grade of milk than the ordinary dairyman has been producing. There are two reasons why this problem is before the farmer at the present time. One is because it has been put before him by the board of health of the cities to which his milk is being shipped for consumption by the people who live in the city. Another reason why this problem is at present prominently before the milk producer is the demand on the part of the general public for purer foods of all kinds. Sometimes we are apt to think that as milk producers we have been made a special object for inspection and legislation, which we perhaps feel is unjust and disadvantageous to our business. I believe, however, the question of the quality of our milk supply has not received more than its due share of attention. There are two reasons why the agitation for purer milk has reached its present stage. In the first place, there is no other one article of food which is used by so many people. Statistics show that in the larger cities and towns of New York State there is an average consumption per capita of over 130 quarts each year. We cannot overlook the fact that any article of food which forms so important a part of our diet should be wholesome and of good quality. In addition to the fact that there is consumed each year an average of 130 quarts for every man, woman and child within our cities, milk constitutes the sole diet for many of the infants and young children throughout the State, and this at the time in their lives when their delicate constitutions are most easily deranged by improper food.

In the second place, there is probably no article of human food so susceptible to injurious changes as milk. This is due to the nature of the milk itself. Being made up as it is of food material in solution, it forms an ideal food for the growth of many species of bacteria when the proper temperatures are provided for their growth. Wherever there is dust or dirt of any sort, bacteria abound in large numbers, and we know how difficult it is to keep a cow stable and the cow herself perfectly clean. The result is that under ordinary conditions the milk becomes contaminated with many bacteria during the process of milking and handling. I believe we can all see, therefore, the necessity for care in the handling of a product which is so easily spoiled and which constitutes so important an article of human diet.

At the present time the boards of health of our cities are insisting that milk shall be produced and handled under such conditions as will insure its cleanliness and healthfulness. It is useless for the farmer to say that he will not produce cleaner milk in accordance with the requirements of our city authorities, because if he refuses to comply with their requirements he cannot sell the milk; for, while the city authorities have no jurisdiction outside their city limits, they have authority to prevent milk being sold in the city unless it comes up to the city standards. I believe the thing for us to do, therefore, is to learn to produce the desired grade of milk, which simply means milk produced and handled under as clean conditions as can be maintained without unreasonable hardship to the milk producers. In order to do that another problem and a serious one is brought before the producer.

The retail price of milk has gone up materially during the last few years and is now higher than it has ever been before. At the same time the cost of feeds and of farm labor has also increased and in greater proportion than has the price of milk. The price of milk may continue to increase and there is no real reason why it should not, but I doubt if we can expect it to go much higher during the next few years. The farmer, therefore, is compelled to produce milk at a relatively lower cost than heretofore and at the same time produce a higher grade of product. This is especially true if he is shipping milk to the city market.

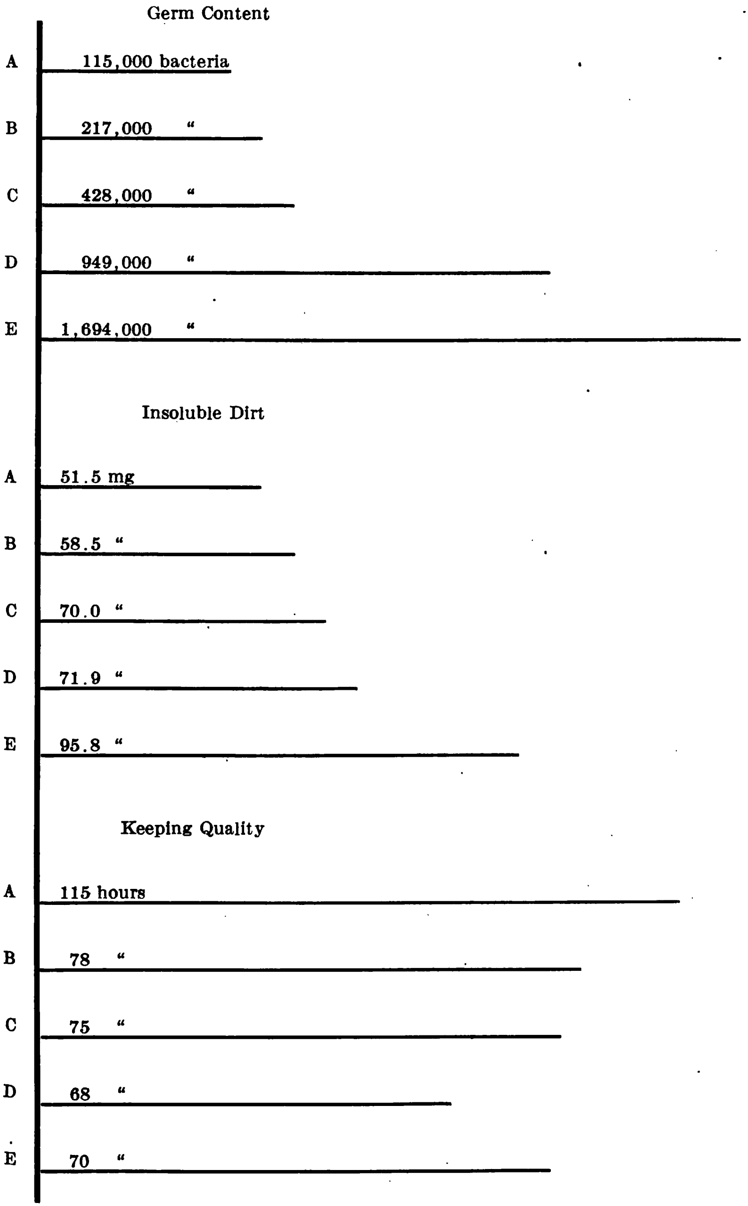
It is however also true if he is producing milk for cheese or butter factories, though at the present time the demand for better milk for these purposes is not as emphatic as for city consumption. The butter and cheese makers in our factories are every year becoming better trained in their methods and more skilful in their ability to make butter and cheese of high grade, and in many of our factories as good a product is made as is possible from the quality of the milk they get. If they are going to raise the quality of their butter and cheese and obtain higher prices, it is essential that they receive a better grade of milk.

In scoring butter and cheese, we know that it is not uncommon to find a given lot of which the judge will say that the milk was bad. He is able to tell from the finished product the quality of the milk which went into it; and since, in the mind of the judge, the price of the finished product depends upon its quality, the question of the quality of the milk supply becomes a matter of dollars and cents to those interested in the factory. If the men who produce the milk will supply the factory with a better quality, better prices will be received for the finished product. In fact, this must be the case if the butter and cheese factories are going to hold their own against the ever-increasing demand for market milk at increased prices.

I believe, therefore, that what the milk producer needs to do is to learn how to produce cleaner milk without increasing the cost of production, and, if possible, even to lessen the cost of production. Many men believe that in order to produce cleaner milk it is necessary to have expensive barns and high-priced equipment. This, however, is not true. The *method* of production is a far more important factor than is the quality of the equipment. Every farmer must, to a large degree, work out his own problems, but there are a few inexpensive things which he may do that will be of much help to him, and I wish to call your attention in the next few minutes to a few of these practices which will help the milk producer along the right direction.

We are in the habit of judging the quality of milk by its germ content. We say one lot of milk is bad because it contains a large number of organisms, while another lot is good because its germ content is small. I would like to point out the relationship normally existing between the germ content of milk, the amount of dirt which it contains and its keeping quality, and see whether or not we are justified in using the germ content as a basis for determining its sanitary condition or lack of dirt contamination. The accompanying chart is intended to show these relationships.

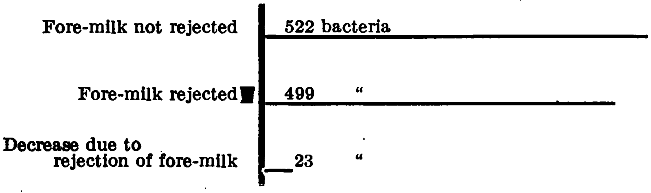
KEEPING QUALITY OF MILK AS AFFECTED BY GERM CONTENT AND INSOLUBLE DIRT



The lines A, B, C, D and E represent averages for a large number of samples of milk. It will be noticed that the samples represented by A contained the smallest germ content, also the smallest amount of insoluble dirt and kept the greatest length of time. The samples represented by B came next in germ content, also in the amount of dirt, and did not keep as well as the samples in A. The same thing is true of the other groups of samples with the exception of E where there was an increase in germ content and dirt, but the samples also kept better than those in group D. This was due to the nature of the dirt contained in these samples. Certain kinds of dirt normally carry a greater number of bacteria than do other kinds, and the milk will, therefore, be affected accordingly. It seems to me that these figures indicate that there is a fairly direct ratio between insoluble dirt and the number of bacteria in milk, and that the keeping quality is in inverse ratio. Can we not, therefore, use the germ content as a fairly correct measure of the quality of the milk? For this reason the rest of the figures which I wish to give you are based upon the germ content of the milk.

There are certain things which a farmer can do to reduce the dirt and germ content of his milk and at the same time improve its quality, which involve little or no increase in labor or cost. On the other hand, there are certain things which he should avoid doing because of their influence upon the quality of the milk. One of the things which is frequently done is to reject the fore-milk, usually discarding two or three streams from each quarter of the udder before the regular milking is commenced. The accompanying figures will show the value of this operation.

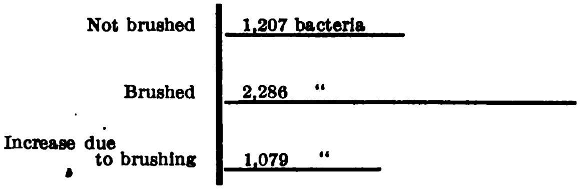
BACTERIAL CONTENT OF MILK AS AFFECTED BY REJECTION OF THE FORE-MILK



If a man is producing certified milk he can probably afford to reject the fore-milk, but for ordinary milk I doubt if the improvement resulting from this operation is worth while.

One thing which should be avoided is the brushing of the cows at or just before milking-time, since this stirs up more or less dust, a part of which is sure to fall into the milk during the milking and affect its quality. The effect of this process is shown by the accompanying figures.

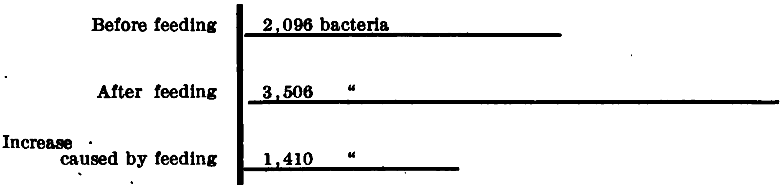
GERM CONTENT OF THE MILK DRAWN BEFORE AND AFTER BRUSHING THE COWS



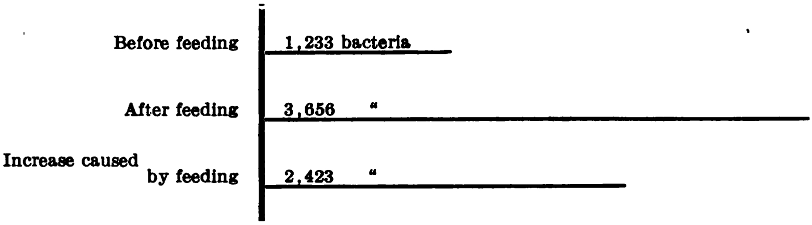
If the brushing is done sufficiently long before the milking so that the dust will have a chance to settle, it will be beneficial, but it should not be done just at the time of milking.

Another practice which is common with many dairymen is to feed the cows just before beginning to milk. Some men believe that cows will give more milk and milk more easily if they are eating while the milking is being done. I believe, however, there are few men who once get in the habit of milking when the cows are not eating, who will ever go back to the old practice. The cows will stand more quietly and the milking can be done much more comfortably if the cows are not trying to eat and at the same time watch the operations of the milker. The average cow does not have brain capacity enough to watch an operation at both ends at the same time. Feeding any dry feed at milking-time is sure to stir up a large amount of dust in the stable atmosphere, and this may seriously affect the quality of the milk as indicated in the two accompanying charts.

NUMBER OF BACTERIA PER CUBIC CENTIMETER OF MILK BEFORE AND AFTER FEEDING HAY AND GRAIN

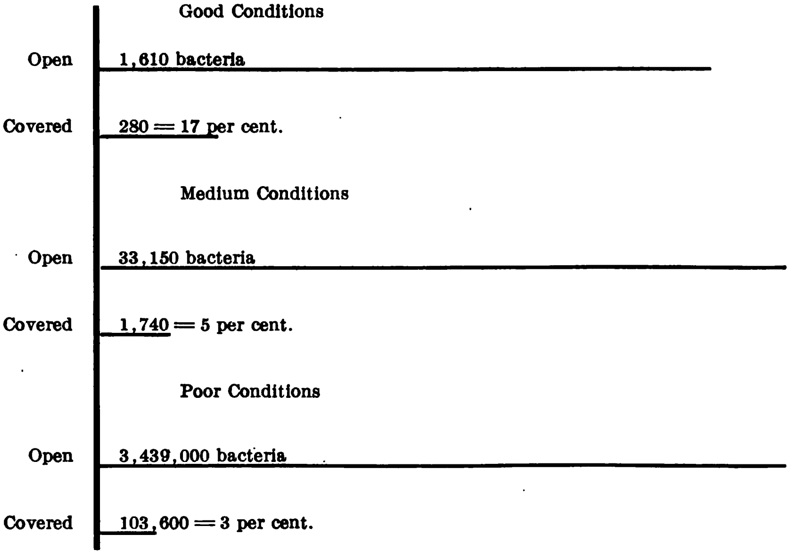


NUMBER OF BACTERIA PER CUBIC CENTIMETER OF MILK BEFORE AND AFTER FEEDING DRY CORN STOVER



What are some of the things which the farmer can do to improve the sanitary quality of his milk? Probably no one thing will have more beneficial effect than the use of a small topped milk pail. The accompanying chart shows the value of such a pail in three grades of stables.

SMALL TOP PAILS



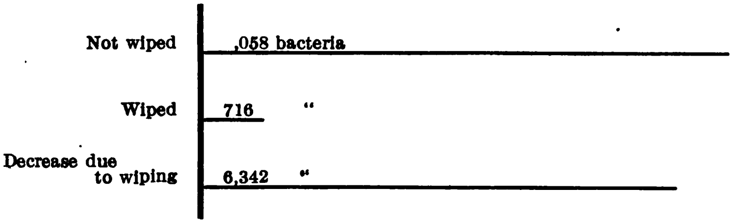
The first stable might be considered somewhat above the average in cleanliness, although it was an inexpensive basement stable and in no way would be considered an ideal sanitary stable. The two sets of figures show the results obtained with an ordinary open pail having a twelve-inch top and a pail of the same size, carrying a cover with an opening five and one-half inches in diameter.

The second stable might well represent an average dairy barn where no special care was taken to keep either the stables or the cows clean. Probably the results in this stable indicate fairly well what might be expected in the average dairy barn in New York State as a result of using a small top pail.

The third barn was a very dirty one, as will be seen from the germ content of the milk drawn in the open pail. Yet even here the benefit resulting from this covered top is very marked. The use of such a pail involves practically no increased expense, and is not at all difficult to use, provided the proper style of cover is used. In selecting a pail with a small top, care should be taken to get one which can be used with ease and which is not difficult to clean.

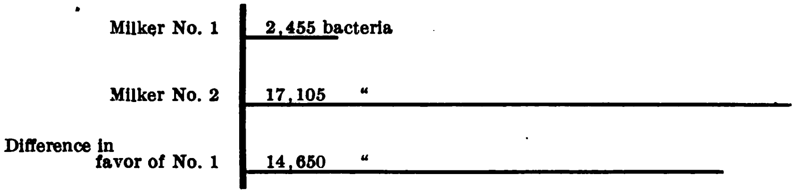
Another inexpensive practice which will have very marked beneficial effects upon the milk is the use of a damp cloth for wiping the side, flank and udder of the cow just before milking. This can be done by carrying a damp cloth and quickly going over these parts of the cow just before putting the pail in position for milking. This operation requires but a few seconds and will remove much of the loose dust which might otherwise fall into the milk pail during the process of milking. The accompanying chart shows the beneficial effect of this operation. It will be borne in mind that all the figures given in these charts are averages for a number of samples and not simply for individual samples of milk.

BACTERIA IN MILK BEFORE AND AFTER THE UDDER AND FLANK WERE WIPED WITH A DAMP CLOTH



These are a few of the things which the milk producer can do to improve the quality of his milk. None of them involve any appreciable cost either in equipment or labor. Even the small top pail can be had at very little expense by getting a local tinner to partially cover the top of your regular pails. Any dairyman by using a small top pail and a damp cloth can produce clean milk in almost any stable which is fit for keeping dairy cows at all. As I said before, the methods used are far more important than the nature of the equipment. While it is desirable to have as good an equipment as possible because of the greater ease with which cows can be kept clean, this is not the most important factor in the production of clean milk. The methods used and the milker himself are the important factors in this work. It is easy for some people to be clean under almost any condition, while it seems to be practically impossible for other persons to be clean under even the best conditions. This difference in personal cleanliness oftentimes shows up among milkers in a very striking fashion, as may be seen by the accompanying chart.

BACTERIAL CONTENT OF MILK DRAWN BY DIFFERENT MILKERS IN THE SAME STABLE



These men milked in the same stable under the same conditions, and yet one got over six times the number of bacteria in his milk as the other. It seems to me the difference in germ content here must represent the difference in natural cleanliness of the two men. One man did his milking with as little motion as possible, without rubbing against the cow or stirring up unnecessary dust, while the other brushed against the cow unnecessarily and dislodged enough dirt to produce the increased germ content.

After we have taken as much care in producing the milk as we can, there will still be some bacteria in it, and these should be prevented from growing by immediately cooling the milk to such a degree that their development will be checked. The more quickly the milk can be cooled to a temperature of fifty degrees or lower, the slower will be the development of the bacteria. The effect of temperature upon milk is strikingly shown by the results obtained from a sample of milk which was thoroughly mixed and then divided into six equal parts. The six bottles were then

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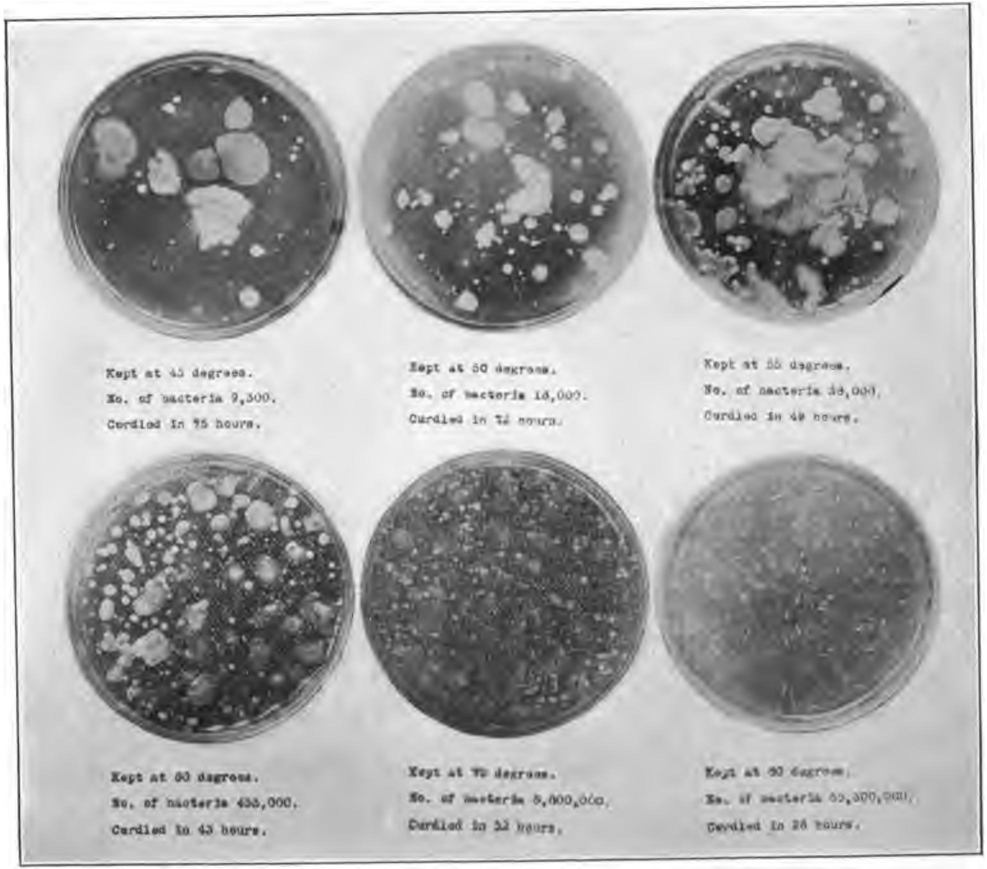

FIG. 18.— EFFECT OF DIFFERENT TEMPERATURES FOR TWELVE HOURS ON THE GROWTH OF BACTERIA AND KEEPING QUALITY OF MILK.

placed in water at different temperatures for twelve hours, at which time the germ content of each lot was determined. The six bottles were then all placed together in a temperature of seventy degrees and allowed to remain until they curdled. As each sample curdled, the time was recorded. The difference in the germ content and the keeping time is the result of the difference in temperature for a period of twelve hours only, and shows what may easily happen in milk which is allowed to stand over night without thorough cooling. (Fig. 18.)

It seems to me that the thing we should do as institute workers is to impress upon the milk producers the fact that they can improve the quality of their milk without increasing the expense of production. Many of the lectures that have been given at institutes in previous years dealt almost entirely with the conditions existing on certified milk farms or other places having expensive buildings and equipment, and it is no wonder that in the mind of the average milk producer the term "clean milk" has become synonymous with "expensive equipment." The average farmer cannot afford to duplicate such an equipment. He therefore says the production of clean milk is out of the question so far as he is concerned. I believe there are few dairymen, however, who would not willingly take steps to improve the quality of their milk if they could see how it might be done without increasing the cost beyond their means. If we can present this matter in such a way that it will result in a supply of cleaner milk for our cities and butter and cheese factories, we will have enabled the producers to receive greater returns for their product, whether in the form of the manufactured products or market milk, and have done great service to the people in the cities, who have to depend upon us in the country to supply them with this valuable article of human food.

Farm Cheese Making

By C. A. Publow

Assistant Professor of Dairy Industry, New York State College of Agriculture at Cornell University

In giving instructions for making cheese of any variety on the farm, it must be known whether the cheese is to be made on a regular commercial basis or whether just an occasional cheese is to be made for home use. If farm cheese making is to be carried on successfully as a regular daily business, then it is necessary to have suitable working equipment that will lessen labor and the cost of manufacture. If cheese is made only for family use, then temporary equipment and utensils may be used with good results.

Up to the time of the establishment of cheese factories in Oneida county in 1851 by Jesse Williams & Sons, cheese was all made at the farm. But as years have gone by, factories, creameries and milk stations have been erected in practically every region where milk is produced. Assistance has been difficult to secure and expense and all other conditions of markets and competition so changed, that to-day there is very little cheese being made commercially at the farm home.

In England just the opposite is true. Nearly all the cheese is made in large private dairies, and the quality averages so high that the selling price is from one to two cents per pound above that of factory-made cheese.

For any food product there is always a ready market if the quality is of the best. There is no reason why just as good cheese cannot be made in a private dairy as in a factory. All other conditions being equal, the quality should be better, because it is easier to care for milk from one herd than from a large number.

Whether or not profitable business can be made of cheese making on the farm depends on several conditions.

1. The location of the farm and its conveniences of transportation to a suitable market.

2. The cost of labor.
3. The skill and business ability of the maker.
4. Intelligent advertising.
5. Reliability, appearance and good quality of all cheese offered for sale.

A farm located near a large city has every opportunity for selling fancy dairy products at a profitable price. A great deal depends on the manner and the style in which the cheese is placed before the consumer. Something new, something clean, neat and attractive is necessary to make the people want to buy. The wants of the consumer must be studied, then every effort put forth to supply these.

Many kinds of cheese can be made in the farm home, but the following are the most practical and easiest to make:

1. Dairy cheddar cheese.
2. Cottage cheese.
3. Cream cheese.
4. Club cheese.

HOW TO MAKE DAIRY CHEDDAR CHEESE

To make good cheese of any variety it is very necessary that the milk from which it is made should be of good quality — that is, it should be clean and sweet. It is impossible to make the cheese any better than the milk from which it is made. The following directions if followed closely will enable an average person on the farm to make a good cheese for home use.

For every ten pounds of cheese required, take 100 pounds of fresh morning's milk, strain and cool it to 60 degrees Fahrenheit. Keep it at this temperature for twenty-four hours or until the following morning. Then put the milk into a clean tin boiler and heat it to 90 degrees Fahrenheit. The heating can be done by placing the boiler on the stove in the kitchen, or it can be placed on a temporary framework and the heating done with a small oil-stove. It is very important that a correct thermometer be used in order that all temperatures in the manufacturing process be correct. As soon as the milk is heated to 90 degrees Fahrenheit, remove the boiler from the stove and allow it to stand for five minutes. Then put three teaspoonfuls of rennet extract in a cup of cold water and pour this into the milk, stirring the milk rapidly for three minutes to insure an even mixing. Then leave undisturbed from twenty to thirty minutes, or until the milk has become firmly coagulated, when it should be cut into small pieces about one-half inch square. Usually an ordinary long-bladed knife is used for this purpose, but much better results can be accomplished by having two small knives constructed by a tinsmith. One should have blades running in a horizontal direction, and the other perpendicularly. These can be made by soldering strips of tin one-half inch wide and one-half inch apart to a light framework.

After the curd has been cut it should be stirred gently for ten minutes with the hand or a small wooden rake. As soon as each little cube of curd becomes coated with a protecting film, the temperature can be raised to 98 degrees Fahrenheit. At least thirty minutes should be occupied in reaching this temperature, and the stirring should be kept up continually to keep the particles from sticking together. When the curd is first cut it is very soft and easily broken, so that it is very important that it be handled and stirred very carefully while in this condition. The temperature of 98 degrees Fahrenheit should be maintained for at least two hours, or until each particle of curd has become firm and springy. The whey should then be removed and the curd piled in one end of the boiler, so that all free whey can drain away easily, or the curd can be placed in a cotton bag and hung up to drain for a few hours. The latter way is preferred. If the curd is left in the boiler, it should be covered and kept warm until ready for salting. In about twenty minutes after the whey has been removed the curd should be turned over, the top going on the bottom. This prevents the outside from drying and becoming harder than the other part. At the end of three hours the curd should be cut into small uniform pieces about one-half inch square and salt sprinkled on at the rate of four ounces for every ten pounds of curd. Then in thirty minutes, or as soon as the salt has become dissolved and the curd mellow, it should be put into strong molds or cheese-hoops, where it can be pressed into suitable shape. A small cylinder cheese-hoop can be made at very small cost from galvanized iron, or very often suitable cheese-hoops can be borowed or secured from a neighboring cheese factory. After being ressed for a few days the cheese should be taken from the press nd placed in a cool, dry cellar to ripen. At the end of five days t should be dipped in hot melted paraffin. This puts a coating n the cheese that keeps it from molding and prevents it from rying too much. The cheese should be turned end for end on he shelf every day or two for the first two weeks, so that it will ipen evenly. It should be ready to eat in six weeks, but if a harp-tasting cheese is desired, it should not be used for at least hree months.

These directions are of necessity brief and superficial, but if ny farmer wishes to make this style of cheese for market, he can ecure full and detailed directions and information on equipment rom the New York State College of Agriculture at Ithaca, N. Y.

HOW TO MAKE COTTAGE CHEESE

Cottage cheese is one of the varieties most simple to make at ome. It is also the most profitable kind of home-made cheese o manufacture for commercial trade. This is true because a eady market is always waiting, and it serves as a profitable way o use up excess skimmed milk and buttermilk. The following ethod of manufacture is the one now being generally used:

One hundred pounds of skimmed milk and twenty-five pounds f buttermilk are placed in a boiler and heated to 72 degrees ahrenheit. When it has become distinctly sour to the taste, two easpoonfuls of rennet extract diluted in one cup of water is dded. Then as soon as the whey is well separated from the curd, is removed and the curd placed in a cotton bag or on a cotton rainer cloth fastened over a wooden frame. Here the curd is llowed to dry, and when all free whey has escaped, salt is applied o suit the taste, generally at the rate of two ounces for every en pounds of curd. The cheese should then be molded into ttractive shapes for marketing. Usually cottage cheese is made nto round balls of about one-half pound weight and wrapped in archment or oiled paper. One hundred pounds of skimmed ilk and twenty-five pounds of buttermilk should make about wenty pounds of cottage cheese, which generally retails at ten ents per pound.

HOW TO MAKE CREAM CHEESE

Cream cheese is made in practically the same way as cottage cheese except that before salting some sour cream is mixed through the curd to give it a creamy consistency. Cream cheese is wrapped in thin parchment paper and tin-foil on the outside.

HOW TO MAKE CLUB CHEESE

Club cheese is one of the very popular varieties found in hotels and restaurants. It is manufactured by several companies, but can be made for home use in the following manner:

Cheddar cheese that is several months old and well ripened is cut into small pieces and put through a meat-grinding machine. About two ounces of best quality butter is then added for each pound of cheese, and the mixture again put through the meat-grinding machine. As soon as all small lumps have disappeared and the butter has been thoroughly mixed with the cheese, it can be packed into glass jars. These should first be smeared on the inside with melted butter. A piece of tin-foil placed over each jar on top of the cheese will prevent mold formation. The cheese is usually put up in square shapes of about one-quarter pound weight and retails for about twenty cents per pound.

This cheese is very tasty and is of such a consistency that it can be conveniently spread on soda biscuits or bread.

Simple Methods of Seed Improvement

By H. J. Webber

Professor of Experimental Plant-breeding, New York State College of Agriculture, Cornell University

My understanding from Commissioner Pearson is that in connection with these talks he desires to have presented material such as the different speakers would present at farmers' institute meetings. In connection with my talk on this subject, therefore, I am limiting myself entirely to the discussion of simple methods of seed improvement of two of our important crops — potatoes and corn. In practically all discussions of seed breeding and improvement, the methods described are too complex for the use of farmers ordinarily and are therefore practically worthless to urge upon them as general propositions. The speaker believes that in farmers' institute work, generally, methods should be advocated which may be conscientiously urged upon farmers as practical methods for general use. It is probable that such simple methods as can be put into general use will be scarcely more than seed selection methods, but if even good simple methods in the choice of seed could be put into operation throughout the State, they would doubtless add very greatly to the value of the crop and pave the way for introducing still better methods.

In a considerable number of our crops two of the most important factors to be considered are the questions of seed selection and seed storage. I am inclined to believe that these are more generally neglected than any other two factors on which the size of the crop depends.

SELECTION OF SEED POTATOES

So far as the speaker's experience goes few farmers are giving attention to the selection of their seed in the case of potatoes, and yet experiments which have been carried out here and there over the country show very clearly that striking improvements can be made by the simple selection of seed from the best yielding hills. Here we have the opportunity of using very simple methods of seed selection, which, if put into operation generally, would probably increase the crop nearly one-fourth, and yet scarcely any farmer is giving this matter any attention. The following method, the speaker believes, is applicable for general use, and he believes that we can conscientiously urge it upon every farmer as an important practical method.

SELECTION OF SEED TUBERS

Probably every farmer knows a good seed tuber, although we are frequently inclined to look upon the largest tuber as the best. This is clearly an error, as too large a tuber is almost as bad as too small a tuber. Probably the best sized potato for general use is one weighing from seven to eight ounces. A potato of this size does not have to be cut when served, but is about the right size to serve to an individual. Again, this sized tuber is well-fitted for cooking as it is small enough for the interior to cook nearly as quickly as the exterior.

It is important that the tuber should have a certain shape as well as a certain size. Probably the most desirable shaped tuber is one having a major axis or length of about three and one-half to four inches, with a width of possibly three to three and one-quarter inches and a thickness of from two to two and one-quarter inches. In a tuber of this shape the center of the potato is only about one inch from the exterior at any point. If potatoes are round and thick the exterior becomes well cooked before the interior is thoroughly done, and if they are mealy, as is desired by Americans generally, the exterior is liable to fall apart and cause a waste by the time the center is thoroughly cooked.

In starting the selection the speaker would advocate that every farmer select tubers for planting of as nearly the ideal shape and size as can be obtained by going over a large part of his crop. He should give special attention to getting correct shape, size, shallowness of eye, etc. These tubers should then be properly preserved, a point which will be emphasized later, and should be planted in a special part of the field the next season; planting as nearly as possible pieces of uniform size. The seed tubers, if properly selected, can be cut into quarters and these pieces will be near enough the same size to answer all practical purposes. Plant these in the seed patch in exactly the same way that the ordinary crop

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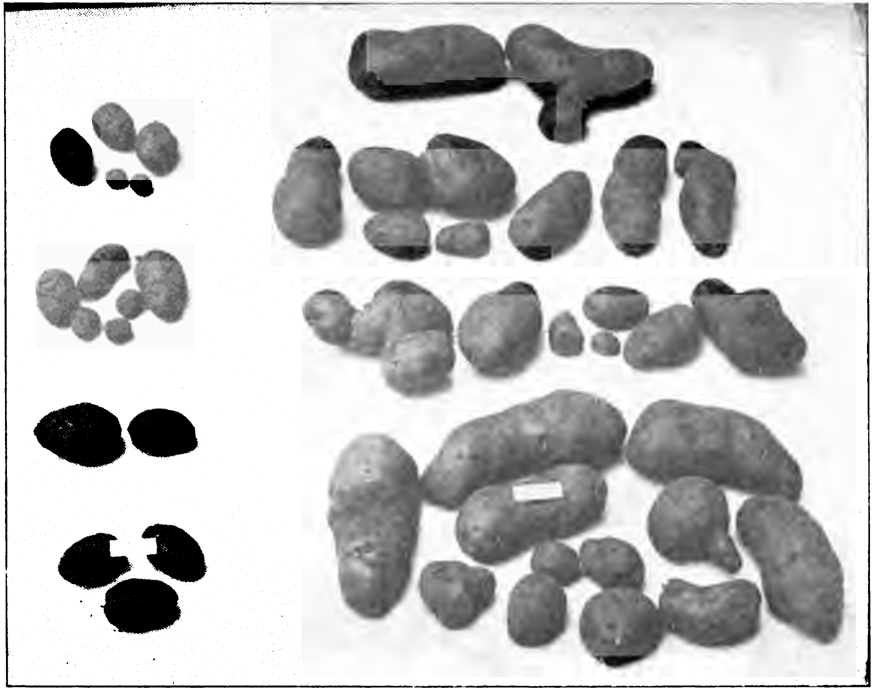

FIG. 19.— SIZE AND YIELD OF DIFFERENT HILLS OF POTATOES.

is planted. It would, of course, be well to have them dropped at about an equal distance apart, as each hill should have the same comparative amount of land for its development. They should also be cultivated the same as the general crop.

SELECTION OF HIGH YIELDING HILLS

The next factor of importance in connection with the seed selection is a selection of the high yielding hills in the seed patch, which should, of course, be done at the time of digging. To do this properly it is necessary that the hills should be dug by hand and the product of each hill laid out separately at the side of the row. If feasible, the entire seed patch can first be dug and laid out in this manner, or the selection can be made while the digging is in progress. To make the selection the speaker would advocate that in the first place all of the hills be examined hastily and the low yielding, poor hills be taken out. The problem before the man making the selection is, of course, to leave only the best hills. The best hills are naturally those producing the heaviest yield of proper sized tubers which are regular in outline. Hills which show a tendency to produce some very large tubers and many small tubers are of course undesirable, though the total yield may be large. Hills which show a tendency to produce tubers irregular in shape, budding out at the sides, are of course undesirable and should be discarded where this condition is marked. Having these factors well in mind, and they are factors which are well recognized by the majority of potato growers, the operator can pass down the rows and throw out the poor hills almost at a glance, leaving only the good, high yielding hills.

After this first process of selection, the operator should go over these good hills and select from among them what Professor Stone calls the "gilt edge" hills, that is, those which are the very best in the field from the standpoint of yield and uniformity of product, and from each of these "gilt edge" hills take the best tubers and retain them for planting the seed patch the ensuing year. After the tubers from the "gilt edge" hills have been removed, the good tubers from the remaining good hills should be selected for planting the next general crop. This is practically all there is to this method of seed selection, and the process should be carried out year after year in the same way.

The proper application of this method will mean that a sufficient number of good tubers are selected in the first instance to plant a seed patch of about one-tenth the size of the general crop grown. This ratio of size of seed patch to general crop would probably hold in ordinary seasons. Ordinarily about twenty bushels of seed per acre are planted, and one tuber divided into quarters and planted in four hills should produce about twenty good seed tubers; the increase, so far as good seed tubers are concerned, being about one to twenty. Therefore, by arranging for the seed patch to be about one-tenth the area of the general crop, we have provided for discarding one-half of the hills in the seed patch. All of the tubers from the discarded hills and all of those not retained for seed, even from the best hills, are placed with the general crop and sold, so it will be seen that the only extra trouble and expense connected with growing this seed patch is the planting and digging by hand and the small amount of trouble required in making the selections. As a matter of fact, this entails very little extra trouble, and every grower who is depending for his living upon the crops produced should be willing to take this amount of time to insure good seed.

STORAGE AND CARE OF SEED POTATOES

The factor of proper storage of the seed is also one generally neglected by growers and is probably no less important. Very few growers give sufficient attention to this matter. It has been found undesirable to store potatoes in large amounts. If they are dug and placed in large piles soon after harvesting, when the weather is still warm, there is danger of their becoming heated and injuring the vitality. If they are placed in large piles in cellars, which is commonly the case, any rot which starts in one tuber is likely to spread rapidly to the others, thus injuring their keeping qualities.

The best way to hold the seed potatoes is, of course, in cold storage at a temperature of from thirty-five to forty degrees Fahrenheit. Should the temperature fall below freezing for a short time there would probably be no very serious damage done, as living protoplasm seldom freezes at exactly freezing temperature. It is better, however, not to subject them to freezing conditions. Most farmers probably do not have facilities for putting their seed potatoes in cold storage, and ordinarily fairly dry, cool cellars form good alternative storage places.

As the selected potatoes are dug in the field, it would be well to place them in open slat boxes or crates of uniform size which may be piled on top of each other. These can be transferred to the cellar and piled up in a comparatively compact space, the crates allowing a free circulation of air, which is desirable. This method of storage, furthermore, allows the grower to examine the seed occasionally during the winter and take out any tubers which may have started to rot before they have had opportunity to affect any of the adjoining tubers. Every precaution possible should be taken to keep the tubers cold and therefore free from sprouting until about two weeks before planting time. It is of the highest importance that the tubers should not be allowed to sprout in the darkness previous to planting, and, if the cellar becomes too warm in the early spring, as is liable to be the case, to hold the seed tubers dormant, they should either be put in cold storage, if such means is available, or stored in pits in the fields and by proper management kept dormant until it is time to expose them before planting.

It is probably not generally understood that it is important to expose the tubers to light a short time before planting. They should be taken out of cold storage, or the cellar, from ten days to two weeks before it is intended to plant them and exposed to the light in some fairly dry, warm place. Several experiments which have been carried out at the Cornell Station indicate the effect which may be expected from such exposure of seed.

Professor Gilmore in 1903 made an experiment with Maine-grown stock of the Sir Walter Raleigh variety, which was rather interesting. About May 5 this stock, which had been kept in excellent condition, was separated into two lots. One part was simply stored in a cool place in the barn and the other part put into cold storage until July 6, when both were planted. The barn stored seed was considerably wilted; sprouts from two to six inches long had formed, which were mostly broken off in the course of planting. The cold storage seed was just beginning to sprout into growth. The yields of these two lots of seed from equal areas were as follows: Barn stored seed, wilted and sprouted, 42.5 pounds; cold storage seed, solid, slightly sprouted, 111 pounds.

These figures show a gain of 159 per cent. in favor of the solid, nearly dormant seed.

Another experiment carried on in 1904 by Mr. S. Fraser, of the Cornell Station, is also interesting in this connection. The seed tubers were stored from November to May in crates in a cool cellar. No sprouts had started May 1. They were then divided into four lots, one of which was put into a dark cellar, fifty or sixty degrees in temperature; another in a cold frame open above, bottom temperature eighty degrees; another in a barn window, temperature near out of doors, and the last in a greenhouse, temperature seventy to ninety degrees.

The following table shows the comparative yields and the increase obtained by allowing the seeds to slightly sprout in the light. The seed in each case being stored by the methods indicated for thirty-six days, May 2 to June 7.

SEED STORED 36 DAYS (MAY 2 TO JUNE 7) IN TRAYS

	In dark cellar 50°–60° average of four plats, pounds	Cold frame open above, bottom 80°, pounds	Barn near window temp. near out of doors, pounds	Green-house 70°–90°, pounds
Carmen No. 3	15.44	26.50	21.25	16.25
Sir Walter Raleigh	16.74	17.00	20.13	20.25
Average of both	16.09	21.75	20.69	18.25
Increase over seed stored in cellar	....	5.66	4.60	2.16
Per cent. gain over seed stored in cellar	....	35.1	28.5	13.4

The sprouts on all of the tubers exposed to the light were strong, dark green, but were only from one-half to three-quarters of an inch long. On those from the cellar, the sprouts were three to four inches long, white and brittle.

The results of the above two experiments and the results which have been obtained in numerous other experiments show that it is desirable to expose the tubers for a short time in a light, moderately warm place before planting. If they are to be planted by machinery they should be exposed to the light and warmth before planting only long enough to allow the buds to begin to sprout.

If they push out for any great length they will be broken off and injured in the planting. Under ordinary conditions, exposure in a light, warm place, for from eight to fifteen days, is probably sufficiently long.

The very largely increased yields which have been obtained from seed properly handled and properly selected indicate that there are no factors more important in the production of a large crop, and potato growers everywhere should be urged to give these factors very careful attention.

SELECTION OF SEED-CORN

Few methods of corn breeding have been suggested which are so simple that farmers, generally, will put them into practice; yet it is supposed that in institute work we should emphasize practical methods. True, the methods of corn breeding which have been devised by experiment station workers are by no means complex, at least not for them, to manipulate. They are, we may conclude, practical for special corn breeders; but the fact that they are too complex for the use of ordinary farmers is testified to by the fact that in New York to-day there are probably not over a half-dozen men who are using such methods.

At the present time much of the seed-corn used in the State, especially for silage purposes, is obtained from states of the corn belt — Illinois, Iowa, Ohio, etc., the varieties most commonly secured being Leaming, Pride of the North, Reid's Yellow Dent, etc. If New York grown seed is depended upon, it is usually some variety of flint corn, commonly the so-called State Flint. The speaker believes that the most important thing to urge upon farmers is to grow their own seed-corn, or at least to use seed of some variety grown in their neighborhood which is known to have given good results. Seed procured from a distance may not be good seed or may have been grown under entirely different conditions. Usually no guarantee of vitality and value goes with it. It is usually shelled, so the grower does not know whether it has been shelled from good, large ears or not. The only way to be sure, therefore, of getting good seed is to raise it oneself or buy it from a local man, known to be growing a good strain adapted to the locality. Practically every farmer knows a good ear of corn, but in this State where early maturing strains are necessary, the tendency is to select too large ears. This is especially true in such good seasons as the last has been, when any variety, medium early in season, matured fully. Ordinarily, however, the dent varieties and large-eared flint sorts have difficulty in maturing in the greater part of the State, and early maturity is thus one of the necessary characters for a successful corn under New York conditions. Large-eared sorts are uniformly late in season, requiring considerable time to dry out and mature. What we apparently desire, therefore, is a variety giving a rather smaller ear than is selected in the corn states of the middle west.

Following is an outline of a simple method of corn selection which the writer believes to be applicable to general conditions and not too complex for farmers to carry out. The method is not advocated as a careful breeding method, but simply as a method of seed improvement.

FIRST METHOD OF CORN SEED IMPROVEMENT

The grower should select twenty-five of the best ears of corn which he can find by a careful examination of a large quantity of ears of a known good variety. These ears should be solid and heavy for their size, of medium length and diameter. They should have deep kernels and a moderately small cob. The kernels should be firmly set on the cob, not moving readily, thus giving a feeling of solidity to the ear. This solidity indicates thorough maturity of ear at husking time. The ear should be cylindrical, have straight regular rows and be well filled at butt and apex. The grower should study different ears until he has well in mind the best type of ear present in the variety he is growing, and each of the twenty-five ears selected should be the best representatives of this type.

If the field of corn is standing from which selections of ears are to be made, the work should be done shortly after the first light frosts. The grower can pass slowly along row after row, stripping down the husks and examining each ear that from outside appearances looks promising. A considerable number of very good, fully mature ears should be selected in this way, and from these the best twenty-five can be selected for the seed improvement work. If the corn has been cut from which selections are to be made, it should be husked before any severely cold weather has occurred, as no opportunity should be allowed for the seed to freeze before it is thoroughly dried. After husking, the twenty-five best ears can be selected as before, the early maturing ears being judged by the solidity of the kernels on the cob.

By whichever method the twenty-five ears are selected when once they are selected, which should have been done before any freezes have occurred, they should be hung up in a warm dry room, preferably a room where a fire is maintained for a portion of the day at least. It is important that the ears dry quickly as this improves the germinability and vigor of the ensuing crop. Preserve these twenty-five select ears together. When ready to plant, first shell off the imperfect kernels at tip and butt of each ear and then shell the twenty-five ears together and plant them in a seed patch at some distance from any other crop of corn of any kind. This insures that individuals from good ears will be pollinated and fertilized by individuals from similarly good ears, which is one of the most important factors in the improvement of any crop.

When this seed patch matures it may be husked standing, or cut and husked from the shock as the farmer desires. Whatever method is used, the seed should be ready for selection before any severe freezes have had opportunity to affect its vitality. From the corn produced on this patch, select again the twenty-five best ears to use the ensuing year in planting a seed patch, and select a sufficient number of the best ears remaining to plant the general crop.

The above method, it will be observed, has in it but one process not now followed quite generally by New York corn growers; this is simply the planting of an isolated seed patch from the best ears so that *plants from good ears will be fertilized by plants from good ears.* This seed patch need not be very large, only from one-quarter to one acre, depending upon the size of the corn crop grown. If a farmer is planting a large corn acreage and twenty-five ears are not sufficient, a larger number can be selected each year and the seed patch increased in size.

This method is not so complex but that every man who is growing from ten to twenty acres of corn could well afford to put it in practice. It requires little time and extra expense and no note keeping. The seed patch could be cultivated alone or in connection with some other crop, such as potatoes. If planted in hills, the seed patch should be thinned to a regular stand of either two or three stalks per hill, according to the richness of the soil. If drilled, it should be thinned out so that there is only about one stalk per foot in the rows. In other words, the stalks in the seed patch should not be crowded.

The general application of even this simple method of seed improvement throughout the State would doubtless mean an average increase of some five bushels per acre in our corn crop.

SECOND METHOD OF CORN SEED IMPROVEMENT

Select the twenty-five best ears obtainable in the beginning as indicated above, preserving them carefully under the best conditions. When ready to plant, shell these twenty-five ears, discarding imperfect kernels at apex and. base, and keeping the grain from each ear in a separate bag. Number these bags 1, 2, 3, etc., up to 25.

1909 Operations.— We will assume that planting operations begin in the spring of 1909. Select a small field where the soil is uniform and which is at some distance from any other corn field, at least from 500 to 1,000 feet, and which is large enough for fifty rows twenty-five hills long. Plant twenty-five hills in each row with five kernels per hill. Rows 1 and 26 should be planted from bag 1, rows 2 and 27 from bag 2, and so on, until rows 25 and 50 are planted from bag 25. In this way the grower will have left over about one-half of the seed of each ear numbered the same as the corresponding rows. Save this seed carefully, keeping each lot in its numbered bag.

After the corn in this seed patch is well up, thin uniformly to three stalks per hill. Should the land be poor, thin to two stalks per hill. Cultivate just the same as an ordinary crop.

In the fall when the crop is mature and before any severe freezes have occurred, husk each of these rows separately and weigh the product, determining which rows have given the best yield. Also carefully note the comparative maturity of the ears from each row, as earliness is an important point in New York. Remember that two rows were planted from each ear to average up the soil conditions. The total yield of the two rows planted from the same ear and their degree of earliness should thus be taken as the measure of value of the original ear. Considering both yield and degree of earliness, determine which of the twenty-five ears planted has turned out the best and select the eight or ten best, making note of the numbers of the rows so selected. Half of the seed of each original ear has been retained, it will be remembered, for further use.

After determining the ten best rows select the best seed ears from these rows and enough more of the best seed ears produced in the remaining portion of the patch to obtain sufficient seed for your entire crop in 1910. This seed should then be dried quickly by hanging in a well ventilated room artificially heated.

1910 Operations.— Select again in 1910 a small field at some distance from any other corn field and prepare for planting. Of the seed retained from the ears planted in 1909, take those sacks numbered to correspond with the rows which were selected in 1909 as superior, mix the seed from these sacks together thoroughly and plant in the isolated plat. By this method it will be noted all of the seed planted will be known to have come from an ear of high producing power and maturing well in general, these points having been determined the preceding year. The general crop this season is planted from the ears selected from the trial plat in 1909.

When the small isolated plat from the select ears ripens in the fall, carefully examine and select the best twenty-five ears and preserve, as in other cases for continuing the selection. After these twenty-five best ears have been selected, sort over the remaining ears and preserve a sufficient number of the best to plant the general crop in 1911.

1911 Operations.— The twenty-five best ears selected the preceding year should be shelled together in sacks numbered from 1 to 25, the poorly formed apical and basal kernels being discarded. This year the isolated test plat should be planted, as in 1909, of fifty rows twenty-five hills long; rows 1 and 26 being planted from ear 1 in bag 1, rows 2 and 27 with seed from ear 2 in bag 2, and so on. The portion of the seed of each of the twenty-five ears not planted should be retained as in 1909 for planting the seed plat in 1912.

When this plat matures in the fall, the product of the progeny from each ear, being in two rows in each case, should be weighed up and the separate progenies carefully judged, the eight or ten best being determined as in 1909, after which a quantity of the best ears are selected to plant the general crop in 1912. The general crop in this year, 1911, should be planted with the second select seed taken from the isolated plat of 1910.

This method of selection, it will be observed, is a two-year method which provides for selecting and testing the yield of the best twenty-five ears the first season, and then the next year growing the select seed, as determined by this test, in an isolated plat together, so that known good producers will be crossed with good producers. It provides each year for taking seed-corn for the general crop from an isolated plat where only highly select ears have been planted.

The only element contained in this method which is not also contained in the first method suggested is the growing of a portion of the seed of the select ears one year in numbered rows and testing their transmitting power, so that when the isolated patch the second year is planted, it will be with seed of ears of tested producing power. This second method is rather more complex than the first, but it is still simple and is doubtless preferable where growers will take the time to carry it out. Either of these two methods, however, will certainly give desirable results and may be unhesitatingly recommended, the speaker believes, for the general use of corn growers in the State.

In conclusion the speaker wishes to state that this is not the exact type of matter which he would ordinarily expect to present before such an audience as this, but following the suggestion of Commissioner Pearson, he has given as nearly as possible such ideas as he believes should be advocated at the Farmers' Institutes for the use of farmers generally. For the man who is going to breed corn or potatoes as a specialty, more comprehensive methods of breeding should be advocated. Some such methods are described briefly in Bulletin 251 of the Cornell Station.

Alfalfa

By G. F. Warren

Professor of Farm Management, New York State College of Agriculture at Cornell University

Value.— The table below shows the total number of acres of different kinds of hay and total yields in 1899 according to the last census.

	Acres	Yield	Yield per acre	Digestible nutrients per acre	Digestible protein per acre
Alfalfa	2,094,000	5,221,000	2.5	2,673	609
Clover	4,104,000	5,167,000	1.3	1,214	177
Cultivated grasses [a]	31,302,000	35,624,000	1.1	1,091	62

[a] Figured as timothy.

It will be seen that from half the area alfalfa gave a little more total yield than clover. Its composition being better it gave over three times the digestible nutriment per acre.[a]

Reports from 400 farmers in Ohio showed the average yield to be three and nine-tenths tons per acre, with a value of $11 per ton or $43 per acre.[b] The average yields in New York are almost the same as those in Ohio, but the value per ton is more.

The value may be overestimated. Alfalfa has almost the same composition as wheat bran. This has led to the common statement that it is as valuable as wheat bran. This is not true. It is always unsafe to compare the feeding values of grain feed with hay on the basis of composition only. The coarser feeds are harder to digest. Feeding trials in milk production on a commercial scale at the New Jersey Experiment Station showed that when bran cost $22.50 per ton, the hay was worth $16.50 as a substitute for it. In this case alfalfa hay was worth a little over two-thirds as much as bran.

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[a] Forage and Fiber Crops in America.

[b] Ohio, Bulletin 181.

CONDITIONS AFFECTING SUCCESS WITH ALFALFA

The most frequent causes of failure are weeds, and lack of manure, lime or inoculation. Occasionally poor seed or dodder causes failure.

Varieties.— In cooperation with the United States Department of Agriculture and with farmers we now have fifty variety tests of alfalfa in this State. Half of these were started in 1906 and half in 1907. The work has not yet gone far enough to give final conclusions. In general, it is much safer to secure seed from a region about as far north as New York. Seed from Kansas is doing well in the tests.

Seed.— The seed should of course be alive and comparatively free from weed seeds. It is sometimes adulterated with bur clover, yellow trefoil and sweet clover. Dodder is the worst weed in the seed. Of 399 samples examined by the United States Department of Agriculture in 1907, about half (191) contained dodder.

Seed should, if possible, be purchased from regions where dodder is least prevalent. Before buying seed, a sample should be examined for dodder seed.

To tell if the seed is alive, place one hundred seeds on a moist piece of blotter paper on a pie pan. Lay another moist blotter over the seeds and place a piece of glass over the pan. At the end of a week count the seeds that have sprouted — 85 to 95 per cent. should sprout.

The beginner should sow at least twenty-five pounds of good seed per acre. Older growers whose soil are in shape for alfalfa may sow twenty pounds. We recommend thirty pounds in the cooperative experiments.

Soil.—Alfalfa is most likely to succeed on porous, well-drained soils, but is fairly successful on some clay soils. The north half of western New York contains large areas of soil that are well adapted to alfalfa. There is probably no county in the State, with the possible exception of the Adirondacks, that does not have some areas that will grow alfalfa.

During the past two years, 171 cooperative experiments in the growth of alfalfa have been taken up by farmers in connection with the College of Agriculture. A large number of such experiments were conducted in previous years.

Sixty-three per cent. of the experimenters report a successful field on some plot. In this connection it is interesting to note that the Oklahoma Experiment Station estimates that not over one in five of the seedings in that State are successful.

On the hill lands of much of southern New York there are relatively fewer successes, but on well drained areas the crop is well worth a trial. In all parts of the State there are gravelly deposits along the stream courses that are well adapted to alfalfa. Such soils should be sufficiently elevated to be comparatively free from floods. Many of the sandy soils of Long Island and Saratoga county can be profitably used for its growth.

Alfalfa will grow on nearly any well drained deep soil if given proper treatment, and grows successfully on many shallow soils.

Lime.—Alfalfa is more likely to need lime than is any other common farm crop. It is more influenced by lime than is clover. Sixty-one per cent. of the cooperative experiments showed the need of lime. About fifteen hundred pounds per acre is a fair application. The lime is best applied as long before the seed is sown as possible.

Inoculation.— Inoculation is absolutely necessary for success. Inoculation may take place naturally or may have to be applied. Soil from sweet clover will inoculate alfalfa. Most of the cases of natural inoculation appear to be due to the previous growth of sweet clover on the soil. Common clover soil does not inoculate alfalfa.

Even in fields that require inoculation for success, a few plants usually become inoculated from some source. These usually look large and dark green as contrasted with the small yellowish uninoculated ones. If such a field is planted and reseeded it is often well inoculated. It is therefore often desirable to make a new trial on ground where alfalfa has thus failed.

Fifty-four per cent. of the cooperative trials have shown the need of inoculation. The most successful way to inoculate is by applying soil from a good alfalfa field or from a place where sweet clover is growing. This is sown on the field at the rate of about four bushels per acre. It is usually easiest to sow it by hand. The soil thus used should not be allowed to become dry before being applied as the bacteria are killed if they become dried.

In applying the soil it is best to apply just before a harrowing. The liquid cultures have rarely been successful in New York.

So far as we know, alfalfa and soy-beans are the only legumes that require inoculation in New York. Alfalfa requires it on most soils, and we have not yet seen any soy-beans with nodules that were not inoculated. The writer has examined clover roots on soils where clover fails and has always found nodules on the few plants that lived.

Manure.—Alfalfa is a heavy yielding crop and requires a rich soil for best results. This is particularly true in the beginning. The manured plots have been best in most cases. In many cases manure has been absolutely necessary for success. Unless the land is rich enough to produce a large corn crop without manure, it should be manured for alfalfa. Seventy per cent. of the cooperative tests have shown manure to be essential.

If the land and the manure are not comparatively free from weed seed, the manure should be applied to a preceding tilled crop, such as corn or potatoes. Or better, apply it the year of seeding and carry on a summer fallow until the weeds are subdued before sowing the alfalfa.

In seeding some of the very sandy lands, it is usually desirable to apply a light dressing of manure that is free from weed seed just after seeding. This will protect the young plants from drouth and from the sun.

Weeds.— Weeds are one of the most serious enemies of young alfalfa. If a well tilled crop precedes alfalfa the injury is likely to be less. A nurse crop keeps down weeds, but may be as hard on the alfalfa as the weeds are. The nurse crop of small grain has one advantage, it dies when it is cut, while the weeds are not killed by cutting. The sure way to avoid weeds is to seed late after a summer fallow. Of thirty-seven trials of seeding before June 20, seventeen were badly injured by weeds. Of seventeen trials of seeding after June 20 only three were injured by weeds.

Time to Sow.— There are successful fields of alfalfa that have been secured in all kinds of ways, but there are two ways that seem to be giving the largest proportion of successes.

The surest way to secure alfalfa is to apply manure and plow in the spring, then harrow the land and keep the weeds down until they are subdued. After this is accomplished sow the alfalfa at some time when the seed bed and moisture conditions are favorable. It may be sown from the last of June to the first of August. Sometimes it is sown after early potatoes with success. It is very doubtful if it should ever be sown alone in New York before the last of June.

If alfalfa is sown in the spring it is best to seed it with barley, using only about one bushel of barley per acre. The barley should be cut for hay before it matures. Barley is better than oats because it shades the ground less.

Those who are growing alfalfa successfully may keep on with present methods, but a beginner will do well to follow one of the methods outlined above, preferably the former.

In no case do we expect returns from alfalfa the first year. The second method therefore gains nothing but the nurse crop. Statistics gathered from the Ohio farmers on this point are interesting. Fifty-nine reported that they had decided to change from seeding with a nurse crop to seeding alone, while only seven were expecting to change from seeding alone to seeding with a nurse crop.

Fifty-seven had decided to continue to seed alone, but to do so later in the season. None who were seeding late were expecting to change to early in the season.

At the Ohio Station alfalfa seeded on May 24 yielded 6,600 pounds per acre the next year; that seeded July 6 and August 3 yielded 9,500 pounds.

The following experiment stations recommend seeding in late summer (not early fall), the date depending on the latitude: New Jersey, Ohio, Alabama, Oklahoma, Maryland, Missouri, Indiana, Cornell, Kansas, North Carolina. Alfalfa thus seeded usually does not need to be cut the first year. If the growth is likely to be too heavy to allow on the land, it should be cut. If it needs to be cut it should be cut early enough to allow for a protecting growth for winter. A growth a foot high makes a good winter cover. If too much is left it may smother the plants. Clipping when the alfalfa is small is often injurious.

Hay Making.—Alfalfa should be cut when about one-tenth of the heads are in blossom. If allowed to stand longer the hay is poorer and the succeeding cuttings are much decreased. It is usually cut three times in New York (Bulletin 221).

An Experiment Necessary.— It is unwise to sow any large area of alfalfa without first learning how to grow it. This first trial should include at least four plots for determining whether lime and inoculation are necessary. All the plots should be manured or else more plots should be added to test the effect of manure.

Suppose that a man uses lime and manure and fails, he knows nothing about whether he can grow alfalfa or not. He might succeed if he applied soil inoculation. If he uses soil and manure and fails, he does not know whether or not he would have succeeded if he had used lime.

Some man will say that he will apply lime, manure and inoculation on all the area to be sure to succeed, but this does not answer the question. Suppose he does this, he does not know but that he would have done as well if he had left off one or more of the treatments. When he comes to sow a larger area he will be applying unnecessary things at considerable expense.

On the College farm there are two soils on which we have grown alfalfa successfully. One produces it abundantly without lime, manure and inoculation, the other on the same farm requires all these treatments for success. If any one of the three things is omitted the alfalfa fails.

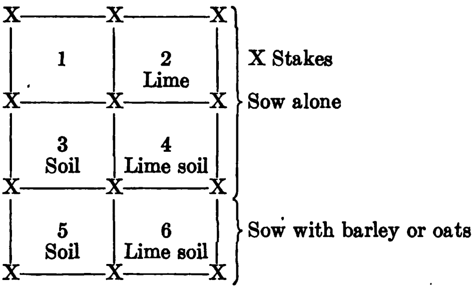
EXPERIMENT

The object of this experiment is to see if alfalfa will grow on your farm and to learn the most profitable way of growing it.

Materials required, six-tenths of an acre of land, twelve stakes, six bushels of lime, fifteen pounds (one-quarter bushel) of alfalfa seed, soil from an alfalfa field or from a place where sweet clover grows.

Directions.— Unless the land selected is very rich, manure should be applied to all the plots at the rate of about ten loads per acre or six loads for this area. Plow the land early in the spring.

Lay off a plot 8 x 12 rods and drive a stake every four rods as in the figure.



Apply six bushels of lime to plots 2, 4, 6. This is at the rate of twenty bushels or about 1,500 pounds per acre.

Inoculate plots 3, 4, 5, 6 with soil from an alfalfa field or from a place where sweet clover grows, using about one or two bushels.

Sow one-third of the alfalfa seed on plots 5 and 6 with about seven quarts of barley or oats.

Continue to harrow the other plots until all weeds are subdued, then sow the alfalfa alone, not later than August 1.

The plot may, of course, be of any size. The above areas are large enough to answer the questions. If one desires to plant a larger area the following year, he will know the best method to use and will have soil for inoculation purposes, if inoculation proves to be necessary on the farm.

Results of Recent Experiments in Potato Spraying

By F. C. Stewart

Botanist, New York Agricultural Experiment Station

You are thoroughly acquainted with the work the Station is doing along the line of spraying potatoes. We are trying to answer the question, Does it pay to spray potatoes in the State of New York? There are three kinds of experiments: (1) Station ten-year experiments, of which there are two each year under the immediate direction of the Station; (2) farmers' business experiments carried on by the Station with the cooperation of the farmer and showing the profit or loss from spraying potatoes; (3) volunteer experiments by farmers. I shall report on only the first two.

In the ten-year experiments conducted by the Station the gain due to spraying was less this year than in any of the preceding years during which experiments have been made. Three sprayings increased the yield twenty-nine and one-half bushels per acre; six sprayings, thirty-nine bushels per acre. There was no blight, a very moderate attack of flea beetles and a moderate attack of tip burn at Geneva. At Riverhead, where there was a duplicate of this experiment, three sprayings increased the yield ten and three-fourths bushels per acre, and five sprayings, fifteen and one-third bushels per acre. In the Riverhead experiment no blight was found, and only a moderate attack of flea beetles and a little tip burn.

The past season was the sixth year during which the farmers' business experiments have been conducted. These experiments were fourteen in number; the total acreage was 200; the average gain due to spraying, eighteen and one-half bushels per acre; the average net profit, $8.53 per acre. Of these fourteen experiments there were three in which the sprayed rows yielded less than the unsprayed. Of course, we cannot believe that the loss in yield was due to spraying. In two of the three, the loss was only three bushels per acre, which might be due to the slight variations in the soil, but in the third case there was an apparent loss of twenty and eight-tenths bushels per acre. Everything seemed to be right and the spraying well done; there was no blight and no flea beetles, the only thing we could see was tip burn and some leaf hoppers. Spraying did not seem to have any effect; on the contrary, during the latter part of the season the neighboring rows appeared to be a little more vigorous than the check rows. It is possible that the arsenite of soda which was used with the Bordeaux mixture may have injured the plants. Although in only three experiments was there actual loss in yield, there were five experiments out of the fourteen which were unprofitable; i. e., the gain was not sufficient to pay the expense of the spray. This year there was no late blight whatever in the State and not much early blight. Flea beetles were moderately troublesome, in some places quite troublesome; tip burn was wide spread, due, primarily, to the dry season and aggravated by flea beetles when present. The leaf hopper also aggravates it to a certain extent. The results of experiments in 1907 have only recently gone to press and the results of the experiments in 1908 may not go to press until the latter part of this month. I have prepared a summary of the ten-year experiments for the past seven years.

Orchard Management

By U. P. Hedrick

Horticulturist, New York Agricultural Experiment Station

The management of an orchard is not a matter to be settled by one man for another. To do so is quite as impossible as it is to tell a man how to manage a business enterprise, a clergyman how to preach, a teacher to teach or a lawyer to win cases. But some methods are common to all business — there are fundamentals in theology, teaching is based on pedagogy and every lawyer must know something of Blackstone. So, too, there are generalities which apply to all fruit growing. The better a man can ground himself in these, the more successful he ought to be in growing fruit. The word "generalities" is used in preference to the more pretentious ones "principles," "fundamentals;" these imply that fruit growing is a science, which it is not, but an art to which a number of sciences contribute. It is well to understand this at the outset and so not expect the principles and formulæ of an exact science in discussing horticulture.

Coming now to the subject, *Orchard Management,* let us approach it by outlining the ground to be covered. The fruits of this climate fall into three classes, tree-fruits, vine-fruits and small fruits. Orchards are plantations of any of these, but we restrict the term in this discussion, as in common parlance, to plantations of tree-fruits. To classify still further, orchards are planted with two general objects in view, to produce fruits for home use and for the market. Again commercial fruit growing is divided into that for a special market and that for the general market. Necessary brevity forbids specific discussion of these three divisions of orcharding, but the fruit grower must not lump them together in this rough-and-ready way. The ideals for each are distinct and the methods that succeed in one division may not succeed in another. The very first question for the fruit grower to settle is as to whether he is to grow for home use, a special market or the general market. Upon this decision largely rests the choice of location and the choice and number of fruits and of their varieties.

Still another division may be made. A man may elect to grow fruit extensively or intensively. In the first case the orchard is the unit; in the second, the tree. Most of the orcharding in America is extensive. Everything is done on a large scale. There are many acres, few varieties, uniformity of method for all varieties, wholesale packing and handling and satisfaction with a low price. In Europe the fruit growing is intensive. Orchards are small, there are many varieties, special conditions and treatment are given each variety, individual trees are carefully trained, pruned and fertilized, the product is packed with all of the niceties known to the trade and sells for a high price. America will long continue to grow fruit extensively and conditions are such that it is far best she should, but her fruit growers could learn much from the intensive methods of the European fruit growers; especially learn to look more carefully after the individual needs of trees; learn, too, "that large orcharding is sometimes small orcharding and small orcharding is often the largest orcharding."

Whatever the kind of fruit grown, the choice of place upon which to grow it demands exceedingly careful attention. All subsequent efforts will fail if a mistake is made in choosing the site for operations. Here, indeed, is "Well begun, half done." In growing fruit for the market, certain economic considerations demand attention; as distance to market, means of transportation, labor, storage, competition, disposition of by-products, cost of production and over-production. Any one of these may prove a determinant of success and each should receive careful consideration. "The weakest goes to the wall" applies in the business of growing fruit as well as in other business enterprises. In growing fruit for home use, these economic factors may be ignored. There are, however, certain natural factors which must be observed in fruit growing for both home and market.

The first of these is latitude which largely determines the annual temperature, the amount and intensity of sunlight and the length of the growing season. Now a man must select his fruits and even more particularly his varieties with reference to latitude and its equivalent, altitude. It is easy enough to select the fruit or fruits for a region in a certain altitude or latitude, but it is far from easy to select the varieties of a particular fruit. Thus the

Ben Davis, Winesap, Romanite and York Imperial groups of apples belong in southern latitudes, while the Concord grape and its seventy or more named offspring belong to the north. So with nearly all varieties of our fruits; they are either northerners or southerners and should be kept where they belong. Still the metes and bounds of latitude may be set aside by such local modifications as hills, valleys, bodies of water, winds and sunshine. Fortunate is the man who has his orchards planted only with sorts suited to his latitude. Climate is the fruit grower's greatest asset and costs him nothing.

As with all crops, the soil must largely determine the value of a location for a fruit plantation, and in choosing land all of the characters, as physical structure, richness, power to retain moisture and depth must be well considered. As everyone knows special fruits have special soil adaptations — the peach grows on sand, the plum on clay, apples and pears on loams; but the knowledge that the several fruits have adaptations to soils is far from sufficient. A man planting fruit should know that each individual variety of any fruit will do better in some soils than in others. The successful fruit grower will discover what these preferences are. The chemist and the soil physicist can help but little here; in most cases an actual test in the field is the only way of knowing whether a variety will or will not thrive in a soil. One property of the soil is too often neglected — namely, its heat retaining properties. The florist knows that the violet and carnation want cool soils, but the rose must have bottom heat. Some fruits, as the peach and the grape, require warm soils; apples and pears will thrive in cooler lands, but in general, a cold, heavy, close soil is a poor one for any of the fruits.

With the location and land selected the next question is, What varieties shall I plant? This question we have touched upon in part in previous paragraphs, and it only remains here to be said that out of the thousands of varieties of the several fruits even the few best ones may be most readily characterized by their faults, showing how necessary it is to make a careful choice of varieties. An intimate, first-hand knowledge of varieties in his own locality is the only way by which a man can become competent to choose the sorts to plant. Look a little askance at novelties. An unbridled passion for "new creations" has been the downfall of many orchards.

It is about as difficult to select the trees of the several fruits as it is to make a choice of varieties. It is not of prime importance, but it is true and therefore worth paying attention to, that trees grown near home are somewhat better than those brought from a distance. It is necessary to look out in buying that trees are true to name, free from pests and that they still have the breath of life. It would seem that only the simple would need to be told this; but I speak within bounds when I say that there is scarcely a fruit grower the country over, big or little, who has not suffered at the hands of some unscrupulous tree dealer in substituted varieties, through the introduction of some pest or through buying dead or worthless trees. And the buyer can only "grin and bear it." It is better, if possible, that the fruit grower have his trees propagated from individuals of known good qualities with the hope that these qualities will be handed down. To do this it may be necessary for the grower to furnish buds or scions.

Unfortunately few fruit growers concern themselves with the kind of stocks their trees are worked upon. Yet this is a most important matter. Apples may be bought upon Paradise, Doucin or home grown or French grown standards. Now the first two named are probably only suitable for the amateur, and of the standards those on the foreign seedlings are usually much the better. Pears are grown as standards on French seedlings or as dwarfs on the Angers quince. The dwarfs are gradually going out of vogue. The peach should be worked upon seedlings from southern pits and not upon those from cannery seeds. Sour cherries on Mazzard stock are far superior to those on the Mahaleb stock, yet the latter is usually planted because easier for the nurseryman to grow and therefore cheaper for the cherry grower to buy — a great mistake on the part of the grower, as trees on Mahaleb stock are dear at any price. Plums are grown upon several stocks, and no one seems to know which are best for the several species of this fruit, the different types of soil and the hundreds of varieties.

After the trees are on hand the vexed problem arises as to how the orchard is to be laid out — whether in squares, quincunxes, hexagons, with or without fillers and as to distances apart. Only generalities can be given here. The first is that a system of squares is usually best because it permits the orchard operations to be carried on most readily. Both roots and branches will utilize all of the space. Second, fillers of fruits other than varieties of the species composing the permanent trees usually serve only to vex the soul. They greatly complicate orchard operations, and under treatment meant primarily for the permanent trees they are neither " fish, flesh, fowl, nor good red herring." Fillers of quick bearing varieties of the same fruit, especially the apple, may often be used to advantage. Third, there should be as many " outside rows " as possible. I mean the trees should be far enough apart for each to develop in full its individuality; for every fruit grower knows that the trees on the outside of his orchard produce most fruit, the reason being that they get most air, sunshine, wind, moisture and food. What better argument for wide planting?

A good deal is being said about sex in fruits and especially about the impotency of varieties whereby their fruits do not set well. My own opinion is that fruit does not set in this region for most part because of frosts, cold weather, rains and heavy winds at blooming time, but still there are some varieties of pears, apples, grapes and plums at least that are self-sterile. The remedy is mixed planting of varieties that bloom at the same time. It is important that the fruit of all the varieties planted have value, as it is not worth while to encumber land with a sort fit only for a pollinator. Contrary to a very general notion, the fruits themselves are not greatly changed, if at all, by cross-pollination.

Pruning is almost prehistoric in origin and is popularly supposed to be the kindergarten operation in fruit growing, yet as now practiced it is a hit-and-miss cutting, sawing, chopping and shearing out of shoots, twigs, branches and limbs, designated by such expressive terms as " cutting-back," " heading in," " dehorning " and " thinning out the wood." There must always be a difference in the details of pruning, but there are a few general facts and principles which every fruit grower should have well by heart. These, briefly stated, run about as follows:

1. Winter pruning increases the vigor of the plant.
2. Summer pruning decreases the vigor of the plant.
3. Root pruning decreases the vigor of a plant.
4. Prune weak growing varieties heavily in the winter; strong growing sorts, lightly.
5. Suckers or watersprouts are often the effect of over-pruning.
6. Heading-in thickens the top.
7. Checking growth by girdling, notching or twisting may induce fruitfulness, but at the expense of vigor.
8. Heavy pruning young trees delays fruiting.
9. All pruning must take into account the habit of growth of the tree.
10. Some fruits bear on this year's wood, others on that of last year and still others on older growths; pruning must take the age of bearing wood into account.

A man can care for his trees better if he makes a sharp distinction between pruning and training trees. The operations of pruning, as given above, have to do with the modification of the vigor and fruitfulness of the plants, but training, properly speaking, aims to keep the trees in manageable shape. Training then, as to whether high-headed or low-headed, open-centered or close-centered, one-storied or two-storied, bush-shape or tree-shape, or according to the Kniffen system, the fan system, the horizontal or the vertical arm systems, depends largely upon the conveniences and the whims and prejudices of the grower. It is probably more important that a definite ideal be chosen and adhered to than that any particular choice be made.

Cultivation is very generally practiced with all fruits excepting the apple; some claim that this fruit in this State can be grown better in sod, in which case the grass may be cut as a mulch or it may be kept down by sheep, pigs or cattle. The various modifications of the sod method of managing orchards have come to the fore because of the performance of a few individual orchards in the State. Unfortunately it is not yet known whether these orchards are the exception or the rule, that is whether or not they represent the average run of apple orchards in New York. Again, no one knows as yet whether these orchards would not have done better under tillage than under sod, for results have not been given the public which show comparative data from the two methods in any of the orchards.

The New York Agricultural Experiment Station has two experiments to test these methods of orchard management. This year we are publishing one of these experiments and a brief synopsis of the results may therefore be given here, the gravity of the issue before the apple growers of the State warranting this premature setting forth of the data. The following are the chief results in a five-year experiment in the Auchter orchard: Annual average amount of fruit on five acres, sod, 340.2 barrels; tillage, 509.7 barrels; difference, 169.5 barrels. Annual acre average, sod, 68 barrels; tillage, 101.9 barrels; difference, 33.9 barrels. The difference in quantity is due to both a difference in number of fruits and in size of the specimens; four estimates of percentage of blossoms show that the tilled trees bear more blossoms than the sod trees, and a count of apples in barrels of first-class fruit shows an average of 434 fruits in a barrel of sod-mulch fruit and of 309 for the tilled fruit; or an average weight of 5.01 ounces for the sod apples and of 7.02 for the tilled.

The one respect in which the sod-mulch fruit surpasses the tilled is in color. But since in every possible test the tilled trees are shown to be most vigorous, and since wounded, diseased and decrepit trees always bear fruit of high color, it can be said that the bright color of the sod fruit is the hectic flush of disease or decrepitude.

The fruit on the sod plat matures from two to three weeks earlier than that on the tilled land, and there is even a greater difference in the length of time the apples from the two plats will keep.

The fruit from the tilled plat is crisper, juicier and better flavored, a fact many times affirmed by those in charge of the experiment and attested to by all of the many apple connoisseurs who have been asked to take a taste.

The growth of trees is more uniform on the tilled plat than on the sod and the crops on the trees, both as to size and quantity of fruit, are more uniform. In commercial orcharding it is greatly to be desired that trees behave uniformly.

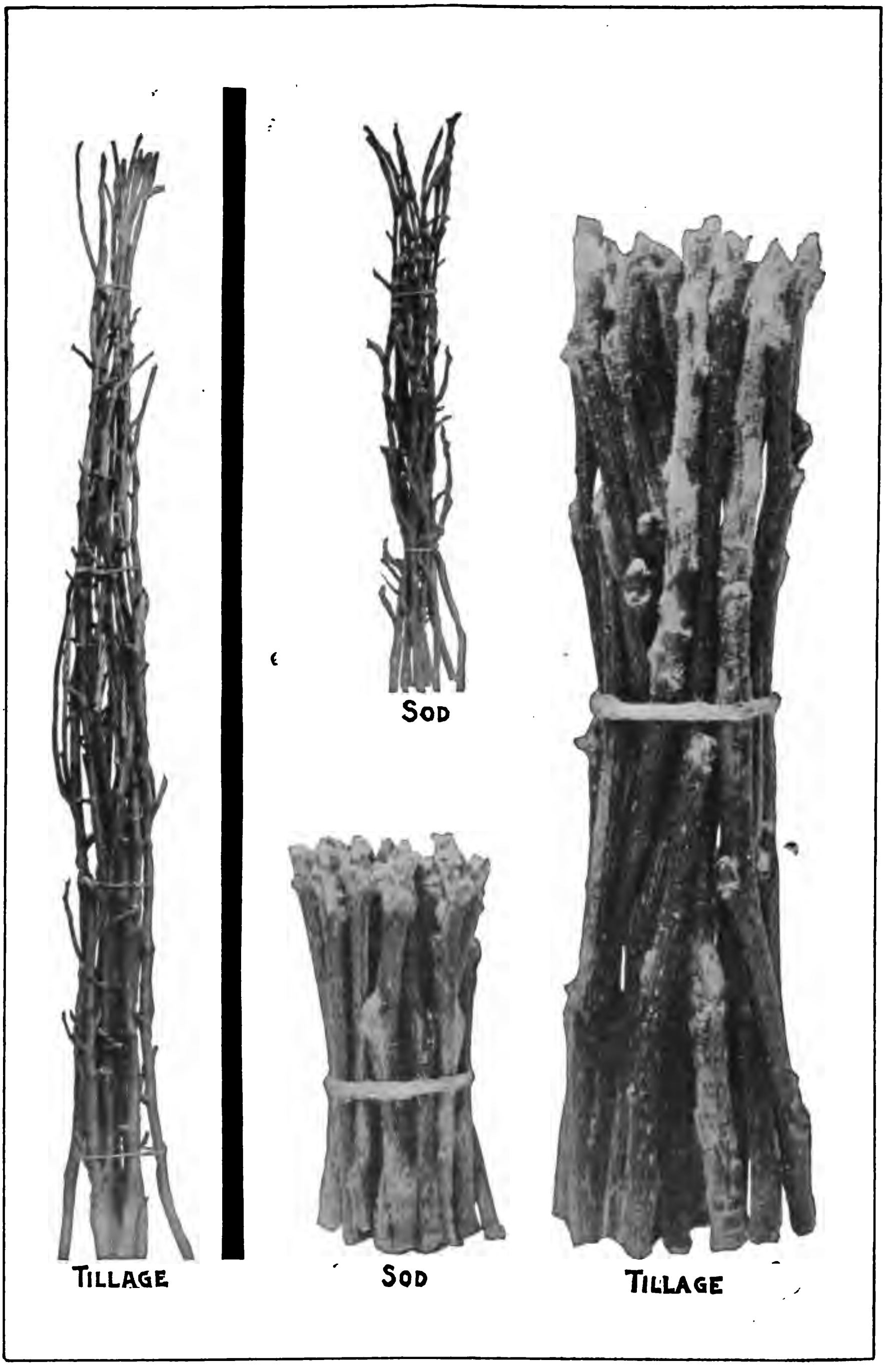


FIG. 20.— COMPARATIVE GROWTH OF WOOD ON SOD AND TILLAGE PLATS IN THE AUCHTER EXPERIMENT. BRANCHES SHOW FIVE YEARS' GROWTH. TWIGS SHOW ONE YEAR'S GROWTH.

In the long run, the crop performance in an orchard measures vigor and health, but in so short a period as five years we must know how the trees themselves are affected. The health and vigor of a tree is almost directly proportional to the increase in the diameter of the trunk. The trees on the sod plat gained an average of 1.1 inches in diameter; on the tilled plat, 2.1 inches. This is as clear-cut and as accurate evidence as can be offered.

The annual growth of new wood on an apple tree is a most important criterion, because it measures both the vigor and the bearing capacity of the tree, since fruit buds may be formed on any of the wood older than one year. The average annual growth per branch on the sodded trees was 3.4 inches; tilled trees, 6.7 inches, the tilled trees making twice the growth made by those on sod.

The foliage of a tree is as ready a test and as delicate a one to determine health as the pulse is to a human being. The tell-tale tints of the leaves alone would convince even the most skeptical of the superior vigor and health of the tilled trees in this experiment, but the size of leaves, amount of foliage, weight of foliage, total leaf area and length of time the leaves remain on the tree, all prove tillage the better method of orchard management to obtain health and vigor of tree.

Liebig's "law of the minimum," according to which the yield of a given crop will be limited by the amount of one particular constituent of food, if applied to all the factors affecting the trees in this orchard will show that one factor alone is quite sufficient to account for the differences noted — namely, the supply of water.

The results of 128 determinations of moisture in the top foot of soil show that in the 2,000 tons comprising the upper layer in an acre there were in the sod plat at any time from June to September 144.4 tons of water; in the tilled plat, 239.8 tons, or a difference of 95.4 tons or 724 barrels or 23,483 gallons. These figures substantiate what is held by all soil authorities, that in this climate, conserve it and save as best you can, the seasonal rainfall on the average soil is not more than sufficient for the best development of any one crop; indeed it is seldom sufficient for one crop. If then, we divide the rainfall between two crops, grass and apples, both must suffer.

A brief financial statement regarding this experiment may be of interest since the claim is so often made that sod-mulch method is cheaper than tillage. The average cost per acre of the two methods of management were for the sod, $17.92; tillage, $24.47; a difference of $6.55 per acre in favor of the sod-mulch. But the cost per barrel of apples, counting rental of land, was $1.65 for the tilled plat and $2.15 for the sod plat, $.50 per barrel in favor of tillage. It is not cheap methods that give highest profits; lowest cost of production gives highest profits.

We pass now to another phase of orchard management — that of inter-crops and cover-crops. The best modern orchard practice permits the growing of inter-crops, hoed crops preferred, in an orchard until the trees come in bearing, and insists upon there being a cover-crop sowed at the close of the season's cultivation to be plowed under the following spring. The use of inter-crops and cover-crops in orchards gives a splendid opportunity for the study of the likes and dislikes of plants, for some plants seem to be really particular as to the company they keep. For instance, there are observations and some experimental data to show that the peach and the potato will not break bread and sup together in peace and if grown in intimate contact the results are disastrous and most so to the peach. Much ill-feeling is manifest between the cereals and the peach; not so marked between the cabbage family and the peach; while members of the clover family are pleasant and profitable companions for Madame Peach. All this suggests that crops for the orchard must be chosen with some care. If an inter-crop is sown, keep tree and crop so separated that they cannot trouble each other. In the use of a cover-crop to check growth, interference with the food and drink of the tree by the cover-crop must be expected; and lastly, in the case of the legumes at least, a crop may be sown which will materially add to the food supply of the trees themselves.

In the present-day fruit growing the horticulturist is not permitted to say much about insects, fungi and spraying. The botanist and the entomologist hold that the Almighty meant them in particular when he gave man dominion over "every creeping thing that creepeth upon the earth." While we shall have to admit that the knowledge and skill of the entomologist and botanist are indis-

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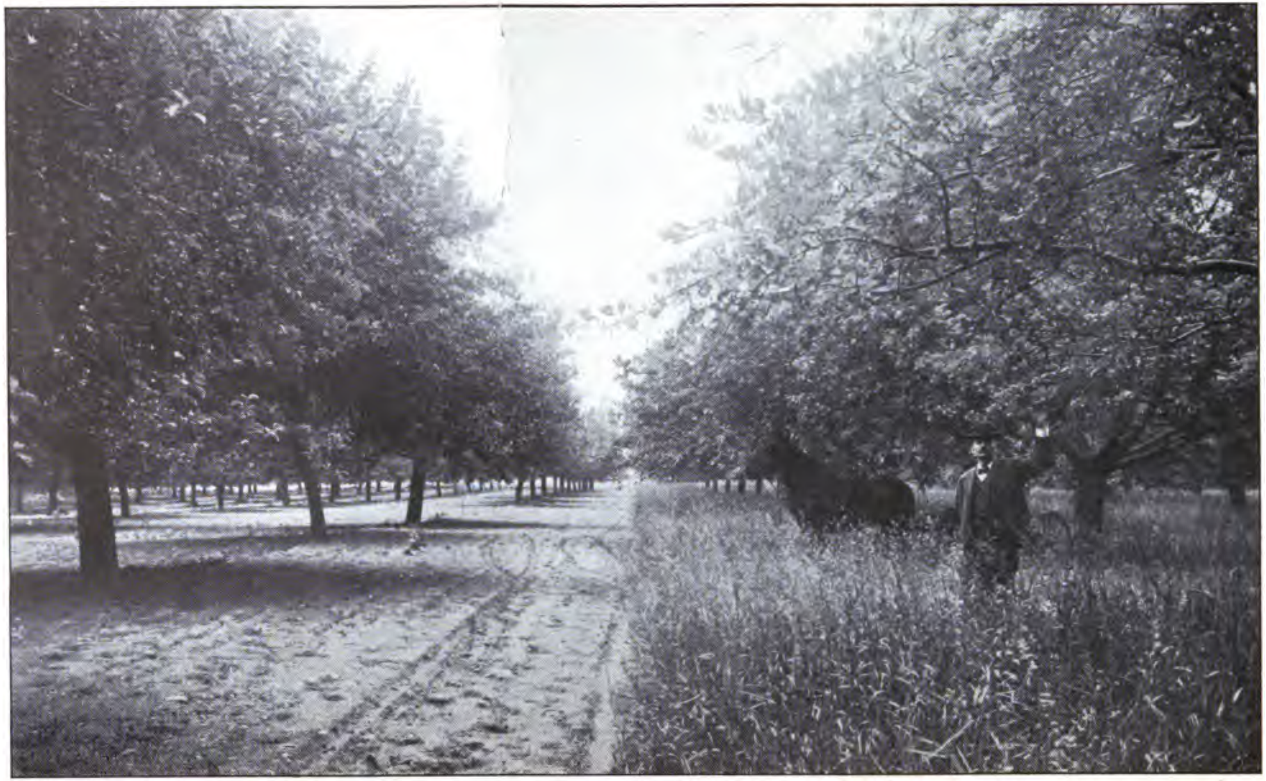

FIG. 21.— TILLED PLAT AND SOD PLAT WITH GRASS AT CUTTING TIME IN THE AUCHTER EXPERIMENT.

pensable, yet the fruit grower can so plant as to avoid some of the warfare with pests in which we are all now engaged. Thus King, Roxbury and Northern Spy among apples are nearly free from scale as are the Kieffer, Le Conte and Winter Nelis pears, Niagara and Field plums and all sour cherries. There are about thirty varieties of apples on the grounds of the New York Agricultural Experiment Station never injured by scab, as many more scarcely injured, and of course a large number that are badly injured. The Seckel, Kieffer, Le Conte and Winter Nelis pears do not blight badly, a few plums are never attacked by black-knot and some peaches are almost immune to peach curl. Now with these, and nearly all other pests, men who can not or will not spray, the general farmer and the city suburbanite, for example, should plant varieties measurably immune to the most troublesome pests.

Two thousand years ago Columella wrote, "The earth neither grows old nor wears out if it be dunged." The truth is a general one and holds with fruits as with other plants. Few will gainsay the statement that if a fruit grower is to crop without crippling over a long period of years he must "dung the earth." Yet I do not believe that fruit crops require the addition of nearly as much fertilizer to the average soil in this State as do farm and truck crops. The basis for this statement comes from observation covering a number of years, the experience of many fruit growers, but more particularly from three experiments carried on at the New York Agricultural Experiment Station. I do not wish to discuss these experiments at this time, but rather to set forth several theoretical considerations as to why fruits in general do not require the addition of as much plant food as farm crops.

1. From 80 to 90 per cent. of a fruit crop is water; the food used in the foliage is returned to the soil. The percentage of solid matter is much greater in farm crops.
2. Trees have a preparatory season of several years before they begin bearing. Farm crops come and go in a season.
3. The growing season for trees is long, from early spring to late fall. It is comparatively short for farm crops.
4. The roots go down and spread out in the case of tree-fruits, but are comparatively restricted with farm crops.

5. Trees transpire relatively large amounts of water and therefore relatively diluted solutions of plant food may suffice to furnish food.

6. All tree-fruits have "off years" in which to recuperate.

7. It is possible to give fruit trees more thorough cultivation, thereby better conserving moisture and making food more available than in the case of farm crops.

It does not follow from what has been said that tree-fruits never need fertilizers, but these considerations make it plain that exceedingly great care must be used in feeding trees if it is to be done without waste. The fruit grower ought to experiment very carefully to see that he gets the worth of his money before using any considerable quantities of fertilizers in an orchard.

Lastly, the fruit grower, of all tillers of the soil, should know the plants he works with; should have an insight into their life processes; should know how they are affected by external conditions; should understand the more or less distinct individuality of each of his trees. Fruit plants are various in kind, and trees of one kind are often quite unlike because the conditions under which they are grown are dissimilar and because plants are inherently variable and plastic. It follows, then, that conditions must vary for every person who grows fruit and that there must, therefore, be more or less diverse ideals, diverse methods and diverse results. But certain forces embraced in what we call "good care" have brought all fruits from the wild to their present state of domestication, and these forces, modified and refined as we gain new knowledge, must be kept in constant operation.

DISCUSSION

The manuscript of the preceding article on "Orchard Management," by U. P. Hedrick, was read by O. M. Taylor, foreman in horticulture, New York Agricultural Experiment Station. After the reading of the manuscript the following discussion was reported:

Mr. Wilson.— How was the experiment to test the tillage method and the sod method of orchard management carried on?

Mr. Taylor.— It was necessary to seed down five acres, as the entire orchard of ten acres had been under cultivation. They were seeded down in such a way that the sod produced a very vigorous growth of grass. This grass was cut and allowed to rot where it fell. It was simply testing this one method of mulch with the up-to-date method of cultivation and sowing a cover-crop. There was a large amount of moisture taken out of the soil by the growth of grass and this is one of the reasons why the trees in the sodded section suffered. I think it would be better to cut the grass twice every year.

Question.— When was the grass cut?

Mr. Taylor.— The first time, it was cut nearly two weeks before the stage of cutting for hay. It was cut once this year, the last week in June.

Question.— Would not the result of this experiment show that in a general way it is better for an ordinary farmer to cultivate his orchard?

Mr. Taylor.— From the best information obtained in studying fruit from every standpoint, there seems to be no doubt but that it would be better under general conditions for an owner of orchards to cultivate an orchard and use cover-crops rather than to leave it uncultivated. Each one must fit his work to the peculiar environment that he finds.

Mr. Gott.— At what time of the season do you think it is best to sow the cover-crop?

Mr. Taylor.— The last of July or early in August. It depends on weather conditions; however, I would not advise later than the 10th of August.

Mr. Gott.— Would there be any difference in favor of color of the fruit if you should apply cover-crops ten days earlier?

Mr. Taylor.— It is possible that if cover-crops were put in earlier and took out enough moisture to check the growth of the trees there probably would be a tendency to color the fruit more.

Professor Card.— What was the cover-crop?

Mr. Taylor.— The cover-crop was clover for three years and oats for two years.

Question.— Does the kind of crop have any influence on the color?

Mr. Taylor.—An excess of nitrogenous food will have a tendency to lower the degree of color, but we have no experiments which give us any light on the subject.

Question.— In the first years did you use any fertilizers on the orchard?

Mr. Taylor.— In the first years we applied acid phosphate and muriate of potash. We applied 400 pounds per acre and spread it broadcast. Experiment was made to see if the soil needed potash, and it was found that it did not appear to need this food. This year we have used no fertilizer.

Mr. Day.— Is it desirable to tell people what varieties they would better plant? This is a question that comes up very often.

Mr. Taylor.— There is an erroneous impression among fruit growers that anyone who has a knowledge of fruit growing can tell them what particular varieties to set out that will bring them the most money, but there are a number of conditions that must be carefully studied before a decision is reached. We cannot decide until we have given the matter due consideration, such as climatic conditions, soil conditions, markets, etc. There are certain localities in the State in which some varieties do much better than others and it is perfectly proper to suggest those varieties and let the man make his choice. If the fruit growers, themselves, will use a little thought and observation, they will soon recognize the varieties best adapted to their neighborhood.

Mr. Day.— Are we justified in recommending some of the fall varieties — Dutchess, Wealthy, McIntosh Red, etc.?

Mr. Taylor.— There is a movement in western New York to plant very largely the fall varieties, and during the past year I am coming to feel that this may be overdone. The season is very short for fall apples, and in western New York we have only a certain number of markets that we can reach. If we were near New York City and could export our apples, the conditions would be different. Those named are excellent.

Mr. Jones.— What would be the advisability of grafting hardier varieties on these? Suppose we have an early apple and want to graft a Greening.

Mr. Taylor.— If it were a healthy tree there would be no objection to working it over.

Mr. Wilson.— Do you think in heading a tree low it has a tendency to dwarf it in the least?

Mr. Taylor.— We have no experimental data that would answer that question conclusively. Wherever I have seen trees that were headed low, I mean eighteen inches from the ground, the trees have seemed to assume a bearing habit earlier than the high-headed trees.

Professor Card.— Do you think it would grow upright?

Mr. Taylor.— The lower branches appear to have a more upright tendency. Professor Paddock, of Colorado, has published a bulletin which covers this question thoroughly.

Mr. Wilson.— Professor Beach contends that it dwarfs a tree to head it too low.

Question.— Did Professor Hedrick imply that a high color of fruit was an indication of disease?

Mr. Taylor.— I do not think that he wished to give that impression, and I do not think that it will be taken that way.

Mr. Brill.— How are you going to get near the low headed trees to cultivate?

Mr. Taylor.— By special tools adapted to these conditions.

Professor Card.— The most troublesome question is fertilizers. Are you willing to suggest any at the present time?

Mr. Taylor.— It depends on the soil conditions of the locality. We hesitate to give a specific formula for the reason that we do not know conditions. Professor Hedrick has issued a bulletin in which he lays out a plan for testing commercial fertilizers for fruit growers and these bulletins are for distribution.

Principles of Plant Pathology

The lecture on this subject by F. C. Stewart, botanist at the New York Agricultural Experiment Station, was essentially the same as one delivered by him at the Normal Institute in 1903 and which was published in the Report of the Director of Farmers' Institutes for the year 1903 (pages 88 to 105). After this lecture the following questions and answers were recorded:

Question.— Is chestnut blight a spore disease? Is it similar to pear blight?

Mr. Stewart.— Chestnut blight is a fungous disease which attacks the trunks and branches of the trees at certain points. It is a very destructive disease quite different from pear blight. Very little is known about the habits of the fungus. It probably gets into the trees through wounds rather than through the leaf buds. The disease does not work with great rapidity. When a branch dies suddenly the disease may have been working in it a long time and only reached the climax then.

Mr. Wilson.— The growth of a fungus is induced by moisture — by warm, moist weather. Was there not an outbreak of the scab fungus on Greening apples throughout Wayne and Monroe counties during the past dry season?

Mr. Stewart.— I have heard that there was a peculiar condition of affairs with regard to apple scab fungus in western New York. It is reported that while there was no fungus in evidence in the forepart of the season, toward the close of the season it suddenly appeared. I was told by dealers in that section that at the time when one might expect fungus on Greening apples there was none, but later, just about picking time, it came on to such an extent that they did not want to buy the apples.

Mr. Van Buren.— We had some in Niagara county the first two weeks in August. The weather was quite warm and showery and that may have been the starting point of the fungus.

Mr. Stewart.— That may have been the cause, but usually it does not work that way. When we get through the forepart of the summer safely, we rarely have trouble with it later.

Mr. Gott.— I know it existed in the northern part of Wayne county and was very prevalent throughout the country. I do not know what time it started or what was the cause. In my own orchard two trees were affected with the fungus and the remainder were free.

Mr. Van Buren.— I would like to ask if there is any new recommendations regarding pear blight?

Mr. Stewart.— I do not know of anything new to recommend except to advise the fruit growers to let alone those fake remedies so numerous at present.

Mr. Day.— Is the saw the best remedy for pear blight?

Mr. Stewart.— Yes, the saw combined with care to avoid over stimulation of growth. Some varieties are more susceptible than others. I do not believe it is at all practicable to cut out the diseased twigs in large bearing apple trees. In young trees it is a good thing to do, but in old apple trees it is impracticable and of no particular value.

Mr. MacDonald.— For spraying apples do you use the same formula of Bordeaux mixture as for potato spraying?

Mr. Stewart.— No, Professor Hedrick advises Bordeaux 3-3-50 for spraying apples; whereas for potatoes we recommend from four to six pounds of blue vitriol to each fifty gallons of Bordeaux. It is a good practice in spraying potatoes to use the 4-4-50 formula in the first two or three sprayings and later to use the stronger formula containing six pounds of blue vitriol.

Mr. Jeannin.— Could the spores of melon and cucumber blight be transmitted through the seed and cause melon blight?

Mr. Stewart.— I am not sure about that. The most destructive cucumber disease we have is a bacterial disease. I do not know whether or not it may be carried on the seed.

Question.— What effect would bisulphide of carbon have on that fungus?

Mr. Stewart.— Probably no effect. Carbon bisulphide has no fungicidal value of any importance. The proper remedy would be the formalin treatment.

Mr. Wilson.— Have you a remedy for dry wheat smut?

Mr. Stewart.— No. Concerning wheat smut I will say that there are two kinds, one which we call the loose smut and another called bunt or stinking smut. Loose smut has been very prevalent in this State. The black powder blows away by harvest time. That kind of smut is not preventable by seed treatment. Bunt is the kind that attacks only the kernels which look very much like normal kernels, but are filled with a brown, foul-smelling powder. Bunt can be prevented by treating the seed with formalin.

Mr. Brill.— Is there danger of spreading apple canker by the knife used in cutting out the disease?

Mr. Stewart.— No, apple canker fungus gets in largely through wounds. It is not an active parasite.

Mr. Curtis.— What practical remedy do you recommend?

Mr. Stewart.— No satisfactory remedy is known.

Mr. Van Buren.— Did you ever try experiments with self-boiled lime and sulphur?

Mr. Stewart.— No, Mr. Parrott will report on that later.

The Leaf Blister-Mite

By P. J. PARROTT
Entomologist, New York Agricultural Experiment Station

The general spotting of apple foliage by the leaf blister-mite has for several years been of annual occurrence. By reason of its conspicuous work in apple orchards, the mite is now regarded by our fruit growers as a pest of growing importance to the fruit interests of this State. With the exception of the San José scale, there has been no insect for the past three years which has generally attracted more attention or which has provoked more discussion among growers in western New York as to its probable destructiveness to apple trees and as to the more efficient methods of control, than has this mite.

THE MITES

The leaf blister-mite is not an insect; it belongs to the Acarina, which constitutes an order of the class Arachinda. Related forms are the true spiders, " daddy-long-legs " and scorpions. Because of their unattractive appearance and habits and obscure structural characters, they have not been of the popular interest that obtains with the insects. To the average person they are practically unknown; nevertheless they are common and abundant. It is said that about three hundred and fifty species are recorded for this country where a thousand or more probably exist. A large number of the mites play an important role in human economy. Among the more important species are the cattle tick, the leaf blister-mite, the red mite and the chicken mites, all of which are first-class pests. Some of the mites find their subsistence upon animals and others thrive upon plants. One of the important groups of plant-feeders is the Eriophyidæ, which includes in addition to other species, the leaf blister-mite.

STRUCTURE AND LIFE STAGES OF THE ERIOPHYIDÆ OR BLISTER-MITES

The mites included in this family are small four-legged animals of a vermiform shape, hardly visible to the unaided eye and varying in size according to the species. The body has two distinct parts: the anterior, which is broad and short and which consists of a head fused with a thorax and known as the cephalo-thorax, and the posterior or abdomen, which is much longer and is annulated and tapering.

The eggs of the mites are round, elliptical or oval and have a thin chitinous covering. They are whitish or yellowish in color, and are quite large compared with the size of the parent. The young larvæ are similar in appearance to the adults and are distinguished from them only by their smaller size, the less number of setæ and the absence of the external parts of the genital organs. The nymph shows a further approach to the adult size and a greater development of the genital organs.

LIFE HISTORY OF THE LEAF BLISTER-MITE

The winter is spent by the mites in the buds, preferably under the second and third layers of the bud scales. If the numbers are large they are often segregated into colonies, forming an entangled mass of fifty or more individuals in a depression or groove of the bud scale, more or less concealed by the pubescence. With the approach of warm weather in the spring, the mites become active and may usually be seen in the greatest numbers toward the base of the growing bud scale where subsistence is obtained. Molting appears to take place about this time with many individuals of the colony, the cast skins being attached to the smooth portion at the top of the bud scale. As the buds burst there is a movement of the mites to the unfolded leaves, in which the eggs are deposited. This migration takes place with the maturing of the bud scales during the latter part of April and early May, depending on the season, soon after which the discoloration of the leaves by pale and red colored spots occurs. The mites burrow through the epidermis of the underside of the leaf and feed upon the cellular tissue of the interior. The irritation produced by these operations gives rise to a thickening of the leaf which is known as a gall or blister. Within these galls eggs are deposited, and the young find subsistence, channeling in all directions, and develop to maturity. Through the tiny openings in the under surface of the gall the adults pass to and fro, and seek other spots to produce fresh galls in which to start new colonies. The production of young and the migration of adults is continuous through the growing season, and in favorable years the numbers of the mites are sufficient to completely infest the unfolding leaves of the new growth as they appear. Mature mites are present in the leaf tissues during the first week of May, and from then on through September eggs and larvæ are present in the leaves. During the latter part of May and the first of June, the mites in greatly increased numbers may be found in the pubescence of the young wood, upon the leaf stems and upon the unfolding leaves of the new growth. During October the mites largely abandon the leaves and swell the numbers already in hiding in the buds and in the pubescence of the bark of the new wood. Hibernation occurs under the bud scales and apparently none of the mites pass the winter in the pubescence or in the crevices of the bark.

MITE WORK ON APPLE LEAVES

The work of the mite on the apple shows first on the upper surfaces of the leaf as distinct, light colored pimples, and on the under side as blisters or thickened areas of the same color as the leaf. The affected areas are of irregular size and are unevenly distributed, though the larger proportion of them are about the sides and the base of the leaf. Some of the blisters may have a reddish tinge, somewhat similar to the pear leaf galls, but ordinarily of a less brilliant color. As the galls become older they appear as corky spots of a reddish brown color, which to the touch are very distinct from the healthy portions of the leaf. The individual galls average from one-twelfth to one-eighth of an inch in diameter and are usually oval or quadrangular in shape.

Leading to the interior of each affected area there is usually one or more tiny openings. Often the spots coalesce, forming irregular dead areas, with a smooth or slightly raised surface and of a dark brown color, which rupture the leaf at the margins. Severe infestation seems to destroy the fresh color and gloss of the leaves and may cause them to be much wrinkled or to curve over, exhibiting the under surfaces. (See Fig. 22.)

About July 1 the most striking effects of the mites upon the leaves appear, especially if there is much yellowing of the foliage, as frequently occurs. Upon the upper surfaces of such leaves, the mite-infested spots are of a light brown or of a dark green color and are uniformly brown beneath. These spots are thickly massed, forming a dark, broad band of irregular width along each side of the leaf, which contrasts conspicuously with the intervening light yellow area about the main rib. To one standing on the ground and viewing the leaves from beneath, this striping of the leaves is very suggestive of variegated foliage of certain ornamental plants.

The mites also injure the fruits and the fruit stems. As a result of the attacks by the mites, the young fruit soon after setting presents light green pimples about one-eighth of an inch in diameter, which stand out in marked contrast with the darker colored surface of the apple. These swellings are usually irregularly grouped about the calyx cavity. Apples that are half grown may show light, blister-like areas of one-quarter of an inch in diameter, suggestive of pockmarks, variously distributed upon the surface, usually about the calyx cavity. These markings would ordinarily pass unnoticed and seem in no way to affect the value of the fruit. Injured apple stems show somewhat similar pimples of a smaller size, and severe infestation produces much thickened stems, which present a very irregular outline. In several instances the work of the mites upon the leaves and fruit stems of the same cluster has so weakened the stems as to cause the falling of the fruit. Premature dropping of the apples by this means seems to be of rare occurrence and even on the worst infested trees is not sufficient to appreciably affect crop production.

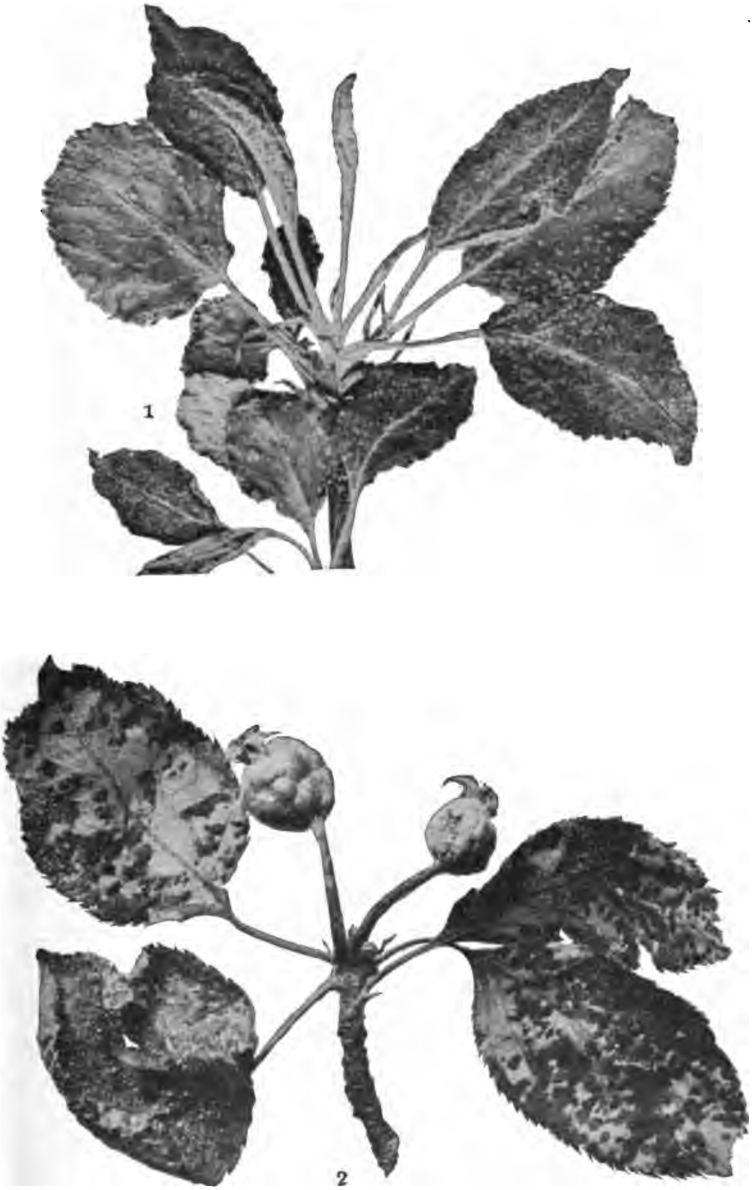

Fig. 22.— (1) Young Leaf Cluster Showing First Appearance of the Mite Injuries. (2) Old Leaf Cluster with Galls on Fruits and Leaves.

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EFFECTS OF MITE ON CROP YIELDS

The actual damage to apple orchards by the mite cannot be accurately determined, and figures on the effects of its attacks on crop yields are largely conjectural. Not infrequently injuries by the mite have been confused with the work of other destructive agencies. The unfavorable conditions of some orchards, said to be damaged by the mite, may be more justly charged to several contributory causes, such as poor drainage, injuries by winter and by various insects and spraying mixtures.

Orchards that are subject to an adverse environment through lack of fertility, improper methods of tillage or droughty conditions of weather, usually show very plainly the effects of the mite, while closely adjoining plantings, which are grown in well-drained, fertile soil and given the needed tillage to stimulate a vigorous growth, may largely outgrow injuries by the first attacks in the spring and produce good yields. During 1908 it was quite generally observed that timely rains favored the development of new foliage and, in spite of early fears of losses by the mite, apples were abundant and of uniformly larger size than for several years.

Fruit growers whose trees have been much infested believe that the mite has caused more or less dropping of the young fruits, and that the general infestation of the foliage lowers the vitality and productiveness of the trees and injures the leaf and fruit buds for the next year's crop. In badly infested orchards, especially where other conditions have not been favorable, the mite has unquestionably influenced unfavorably the production of crops, since the foliage could not be diseased to a great degree without the vitality of the trees being affected. This influence, while not easily measured, has undoubtedly been important in a good many orchards, but in general there has been a tendency to overrate the actual damages by the mite.

SPRAYING FOR THE LEAF BLISTER-MITE

The most practicable remedy for the mite is the lime-sulphur wash. Fruit growers who spray their trees thoroughly with this mixture will experience no especial difficulty in protecting the foliage of their trees from the work of this pest.

Applications of the lime-sulphur wash may be made in the fall after the majority of leaves have fallen, or in the spring until the buds commence to break and show the tips of the young leaves. Treatment should not be made later than this as the sulphur sprays are very destructive to the tender foliage, and the mites may have gained entrance into the leaves, where they would be beyond the reach of the mixture. If it is desired to treat the trees in the spring, the usual spraying at this time with the Bordeaux mixture is necessary. By following this plan the work of spraying for the mite is greatly simplified, and for this reason it is generally preferred by orchardists. Liberal quantities of the sulphur wash should be applied and the trees after treatment should have the appearance of being completely whitewashed.

COMMERCIAL PREPARATIONS OF LIME-SULPHUR WASH

During the past year a number of these preparations have appeared on the market. Two of the most widely advertised have been quite extensively tested in various station experiments with the blister-mite, and at the strength employed, one part of the preparation to nine parts of water, have proven very efficient remedies. A number of volunteer experimenters have reported equally satisfactory results. Fruit growers, who have heretofore refrained from using the lime-sulphur wash for the mite because of the trouble of making and the expense of a suitable cooking outfit, may now use one of the commercial brands. Usually some lime paste should be added to these preparations as, without it, it is difficult to tell how thoroughly the applications have been made.

A PLAN FOR SPRAYING APPLE ORCHARDS FOR BLISTER-MITE AND CASEBEARERS

Many fruit growers who are planning to spray their apple trees this spring with the lime-sulphur wash to control the leaf blister-mite, have also to contend against casebearers. The question arises as to what is the most practicable plan of treatment, including an application of a sulphur spray. In the use of these new sprays it is important that fruit growers should understand the range of usefulness and the conditions under which they may be advantageously employed in the general treatment against diseases and insects which attack the apple. The following points should be clearly understood:

1. The sulphur washes are contact insecticides and are especially recommended for the treatment of the San José scale and the blister-mite. They are of little value for fruit- and leaf-eating insects, such as case-bearers, canker worms and codling moth.

2. The sulphur washes are destructive to foliage. They can be used safely only when trees are dormant or during the time when the buds are swelling and are showing green at the tips. Applications made later than this time may cause serious injuries.

3. The chemical reactions that occur when poison is added to the sulphur wash are not thoroughly understood. It appears to be advisable not to combine arsenicals with sulphur sprays.

4. The sulphur washes are also fungicides, but their effectiveness for most diseases of fruit trees has not been determined. If applied early in the spring, sulphur sprays will control peach leaf-curl. They are also of some value for apple scab, but the exact conditions under which they may be depended upon to control this disease have not been ascertained.

5. To destroy casebearers, the chief reliance must be placed on arsenicals. The poison, preferably arsenate of lead, should be used with Bordeaux mixture. Applications are advised during the time that the buds are breaking and before blossoms open. This treatment also helps to control apple scab.

A plan of treatment which would appear to meet the needs of fruit growers who desire to spray for the leaf blister-mite and case-bearers, is as follows:

1. Spray trees for the blister-mite with a sulphur wash as buds are swelling and showing green at the tips.

2. Spray trees with Bordeaux mixture, containing an arsenical poison, preferably arsenate of lead, before blossoms open. This

should be done from five to seven days after (1). This treatment is effective against many leaf-eating insects and various plant diseases.

3. Spray trees with Bordeaux mixture containing a poison just after blossoms fall. This is the most efficient treatment for codling moth.

4. Spray trees with Bordeaux mixture containing a poison from ten to fourteen days after (3) for codling moth and apple scab.

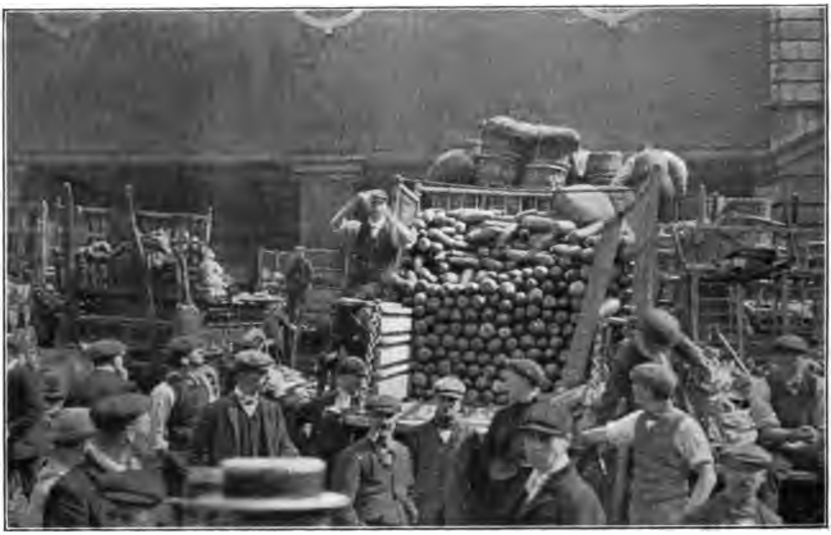

FIG. 23.— RETAIL SECTION OF THE GREATEST MARKET IN THE WORLD — COVENT GARDEN, LONDON.

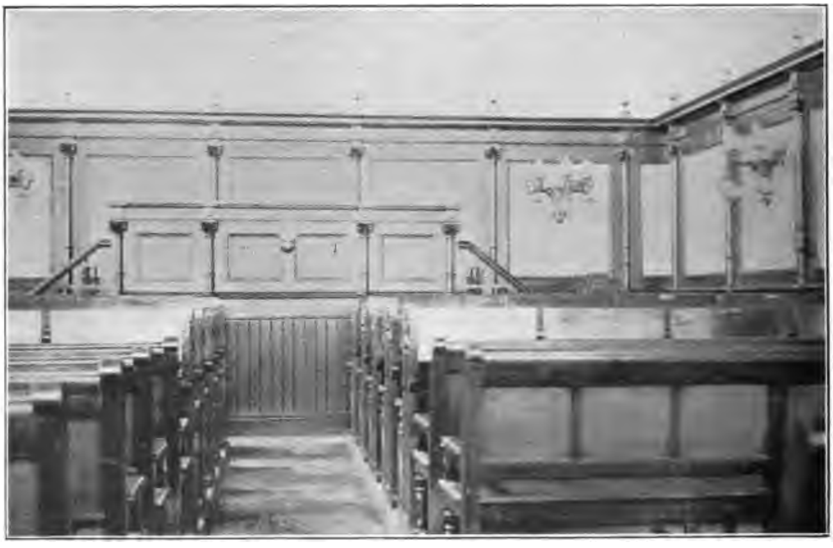

FIG. 24.— FRUIT AUCTION ROOM IN HAMBURG, GERMANY.

American apples auctioned at 10 o'clock each day in this room during the fruit season.

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A Comparison of Horticultural Conditions in Europe and the United States, Educationally and Commercially

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By John Craig

Professor of Horticulture, New York State College of Agriculture at Cornell University

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The subject will be considered from three standpoints:

1. Status of educational opportunities.
2. Status of fruit growing practices in Europe.
3. British and European markets for American fruit.

1. When measured by the number of institutions devoted to the teaching of agriculture and horticulture in Europe in a given area as compared with the United States, France, Germany and Italy much surpass us in that respect. For instance, Italy has five colleges of agriculture; Germany and France each has as many or more than Italy. These colleges give instruction in agriculture and its allied branches. The instruction usually partakes of the theoretical type formerly more in vogue in this country than at present. The student in these colleges does not, as a rule, take kindly to laboratory work which involves physical exercise. The laboratories are replaced by what are called "demonstrations" in which the instructor is the principal actor and the students form the audience. Students are trained carefully in the theoretical part of horticulture and are often well grounded in the principles of the subject. In Italy it is a common practice to send the fourth year student or senior to a farm where he acts as superintendent and demonstrates his ability to manage such an enterprise, and some of the colleges carry this out as a regular part of their course; that is to say, they give three years in the college and one year in which the student officiates as farm manager or superintendent.

The secondary schools for training in horticulture and gardening are exceptionally good in western Europe. These are all of long standing in France and Germany, but of more recent establishment in Italy. I have found the schools specially devoted to horticulture well equipped and doing excellent work. These schools have good laboratory facilities, including greenhouses, grounds and gardens. The men learn gardening as a trade, the purpose being to train gardeners to take charge of private estates. They do not study commercial fruit growing or truck growing or market gardening or floriculture as a business, but rather get careful instruction in the handicraft lines; how to plan, plant and manage gardens designed to furnish fruit, vegetables and flowers to estates and families of wealth. There are some fifteen of these schools in Italy and twenty or more in Germany. It was interesting to discover that in Germany there were two or three schools privately maintained and conducted, and these were successfully competing with those under governmental patronage and officially supported. These schools grant diplomas but not degrees.

In Italy nearly all institutions teaching agriculture or horticulture have extension departments, *cathedra ambulanti.* In this way efforts are made to reach the people. The extension departments give itinerant instruction, carry on demonstration and illustration experiments and conduct a line of work very much after the fashion of that maintained by the colleges of agriculture in this country.

Most of these institutions, even those of secondary grade, maintain experiment grounds in addition to demonstration grounds. The experiments in the German experiment stations, as a rule, represent the permanent and long-term type. This is in contrast to the short-term, incidental, or temporary type of experiment often seen in this country. On the other hand, experiment station work is often not closely related to the pressing needs of the fruit growing classes. In other words, the stations are sometimes not closely in touch with their constituents. The experiments are largely conducted in the departments of chemistry and plant physiology and strictly on a laboratory scale.

2. The fruit growing found on the continent in France, Germany and Italy is strictly of the amateur type. It is more nearly approached by the kind of fruit growing one finds in New Eng-

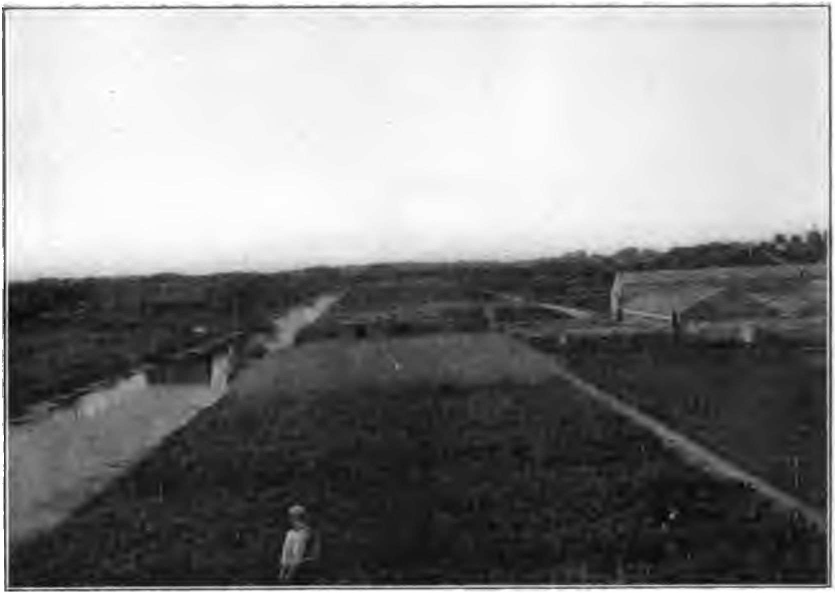

FIG. 25.— THE GREAT NURSERY SECTION OF HOLLAND WHERE TREES ARE GROWN FOR THE AMERICAN TRADE.

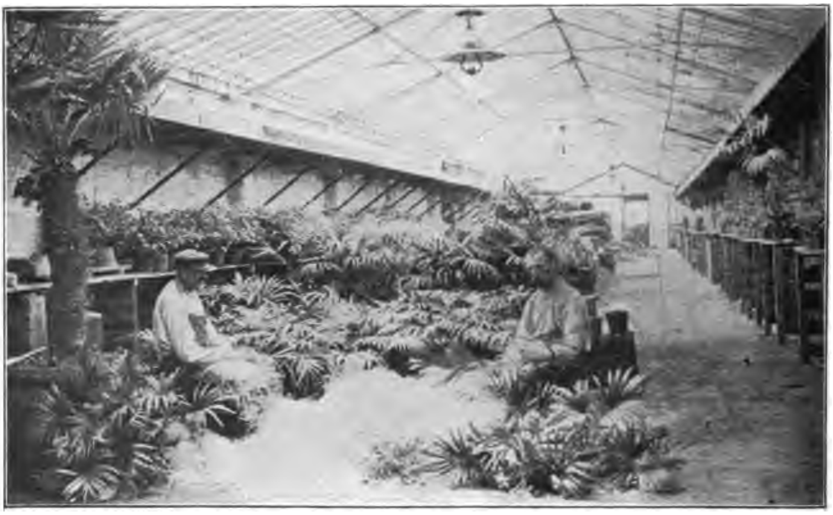

FIG. 26.— A GHENT FLORIST PACKING PALMS FOR EXPORT TO THE UNITED STATES.

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land and is of the kind which prevailed in this country somewhat generally before the commercial era appeared. There are practically no commercial orchards in Germany, few in France and comparatively few in England. In England, however, one will see orchard areas more nearly approaching the commercial stretches that are found in this country than are to be seen elsewhere. The growing of small areas of fruit in garden confines and marketing the product in the local market is the common industry and custom on the continent. Some of the European countries, notably Germany, are making vigorous efforts to introduce American commercial methods in fruit growing, but with comparatively small success. Fruit culture as practiced in the United States is essentially not in vogue in Europe; neither is the type of tillage as we understand it found in European orcharding, but spraying, on the other hand, of those crops which are subject to fungous disease or serious insect attack is general. Vineyards everywhere, whether in Germany, France or Italy, and no matter whether in the hands of the most ignorant peasant or a part of an estate managed by an intelligent superintendent, are thoroughly and persistently sprayed. Dwarf trees and trees trained in various forms prevail in garden and home orchard areas. Standard trees which are not dwarfed by slow growing stocks are found along the roadsides, line fences and are grown occasionally on land too rough for easy cultivation. There is small probability that the amount of home grown fruit will be materially increased in Europe during the present generation. It is interesting to note that in certain parts of Germany the fruit trees along the highway furnish a part of the revenue, and in some cases the entire revenue necessary for maintaining the roads in good condition.

3. Fruit shipped from this country to Great Britain or to the continent goes through a stereotyped process in reaching the consumer. Most of it is sold at auction. Usually the sales are controlled by a group of local buyers and agreements between these buyers for the control of the price may be arranged without great difficulty, although I do not say that such is actually the case. Of course there is a certain amount of competition between the fruit handlers in securing American fruit, but this is hardly keen enough to overrule other advantages which may be derived from

sales at low prices. Since American fruit is sold at auction, it follows that whenever the port of entry is well supplied, prices are apt to range low, although it sometimes happens at the same moment that interior markets, situated at comparatively short distances, are but poorly supplied. The weak point, so far as a somewhat hasty examination of the situation revealed, lies in the distribution of the fruit to the consuming centers in the interior. The visitor to these markets becomes impressed with the idea that less attention on the part of the purchasers and handlers is paid to quality than to appearance, package and grade. It would appear, therefore, that grade is much more important than intrinsic quality. For instance, the Ben Davis apple and Kieffer pear sold last year at good prices in London and in the continental markets. On the other hand, a variety of high quality but poorly graded is scored down severely. The lesson this strongly impresses is that strict attention should be given to grading.

It is also to be noted that the German government is keenly alive to the necessity of guarding against the introduction of injurious insects. There is a law on the statute books which empowers the proper authorities to confiscate and destroy as well as debar further importations should the imported fruit reveal at any time such a dangerous insect as the San José scale, for instance. It behooves shippers, therefore, to proceed with caution. The market for American fruit in Europe is practically unlimited, but the present inefficient method of distributing the product prevents as full a realization of prices as are possible.

CONCLUSIONS AND SUMMARY IN REFERENCE TO MARKETS

1. There appears to be a practically undeveloped fruit market in many of the interior parts of Europe. A large portion of the inhabitants are not to be classed as fruit consumers, for fruit of the type shipped from America is a real luxury. The raspberry, the cherry, the plum and early pears are much commoner articles of commerce and of diet than the apple.

2. There is abundant opportunity for developing markets in the interior regions and away from receiving points. If the distribution is faulty in America, it is much more so in Europe. One

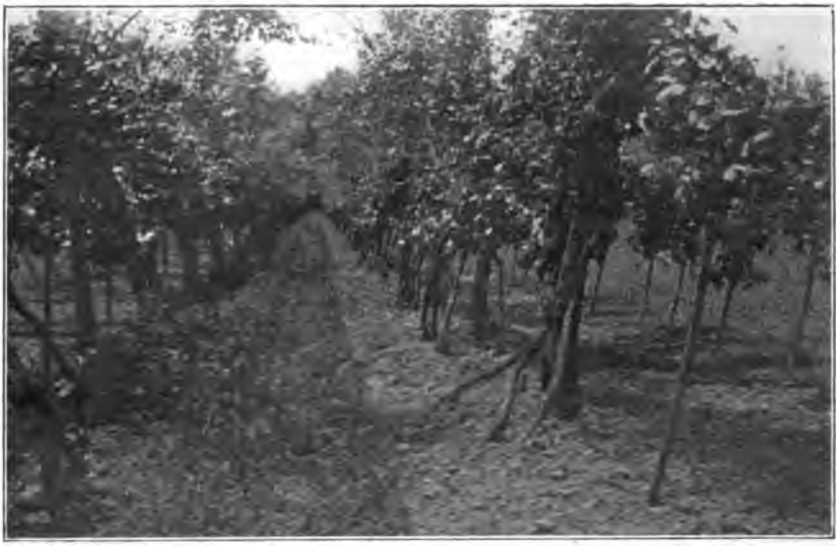

Fig. 27.— Grape-Vines Trained on Trees in Northern Italy.
The tree takes the place of a trellis.

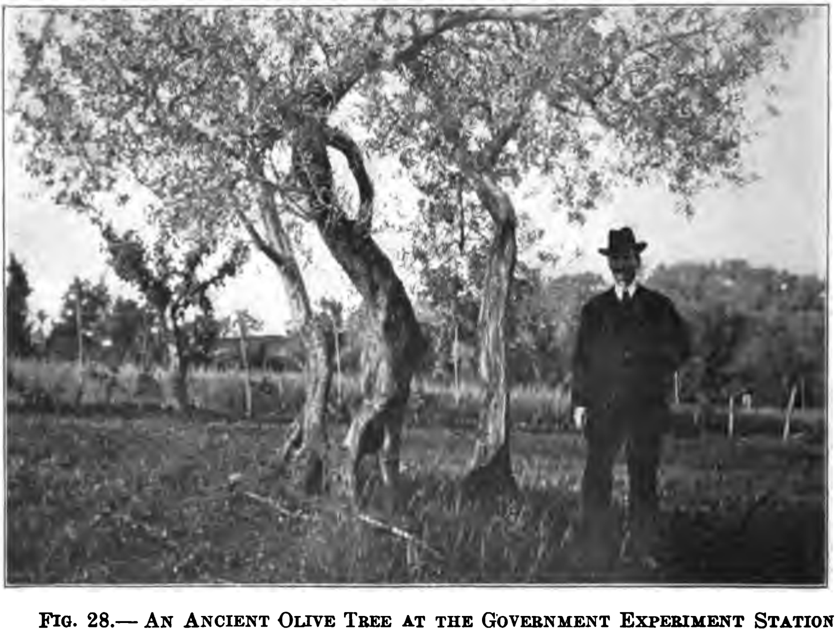

Fig. 28.— An Ancient Olive Tree at the Government Experiment Station at Perugia, Italy.
As the heart wood decays it is carefully cut out, but the cavity is not filled.

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rarely sees apples and peaches in the smaller markets offered at anything like reasonable prices. There seems to be no strong effort on the part of distributing agents at the ports of entry to introduce American fruits outside of the larger cities and along the routes of American and European travel.

3. The handlers of American fruit in France and Germany are opposed by other dealers interested in home grown fruit. This latter class is watching the American fruit trade with a jealous eye and will seize upon any excuse, however plausible, with which to bar American apples from European markets. Germany has at the present time a law controlling importation of diseased or insect infested fruit which may be actively enforced whenever public sentiment is sufficiently strong to bring it into operation. Fruit affected with injurious insects or dangerous fungous diseases would be quite sufficient to bring about the closure. It behooves American importers, therefore, to see that fruit shipped to French and German ports is free from San José scale and reasonably clean.

4. My observation tends to confirm the belief that low-grade fruits, like Kieffer pear and Ben Davis apple, do still sell well and will continue to hold a place in European markets for a long time, provided they are presented in good condition. There seems to be an excellent opportunity for disposing of these varieties in the London market.

5. Grade is more important than intrinsic quality. Probably that is true whenever the one is weighed against the other in any market, but it is particularly true in the case of the European markets where a uniform product is specially desired. I am convinced that an evenly graded box or barrel of Ben Davis apples will sell for more money than a poorly graded package of the same size of Kings or the high quality Spitzenburg. Handlers want uniformity. With this fact in mind, there is some comfort for those who are growing the low-grade varieties.

6. I am of the opinion that the larger and better market for high quality fruit is to be found right here in the United States. American markets are more discriminating as to quality, and there is a larger public desiring good quality than there is in Europe. This is so because Americans are much more a fruit eating people by reason of their opportunities than Europeans.

DISCUSSION

Question.— Do you hear as much about spraying in the old country as you do here?

Professor Craig.— They are very systematic and methodical sprayers. In Italy the vines are sprayed with the utmost care. You can see by a glance that the vineyards have been sprayed and you can notice the difference at once in the block that has been sprayed and the block that has not been sprayed. They use a knapsack pump.

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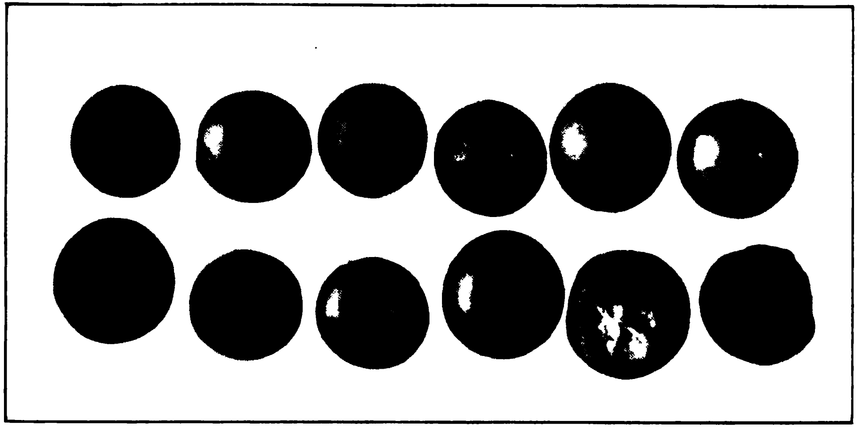

FIG. 29.— SUCCESSIVE STAGES IN THE ROTTING OF THE BERRIES.

Black Rot of Grapes

By Donald Reddick
Instructor in Plant Pathology, New York State College of Agriculture at Cornell University

Black rot is by far the most serious fungous pest of the grape that New York vineyardists have to contend with. The disease is a native of North America and was found early in the nineteenth century on the native wild vines. In 1848 it completely destroyed the Longworth interests near Cincinnati. In 1864 it was again epidemic, also in 1885 and 1886. The disease has always been with us and always will be, and the man who sits down and confidently waits for the rot to run out will sit a long while.

VARIETIES OF GRAPES AFFECTED

All of the commercial varieties of grapes are susceptible to black rot, but the general impression among growers is that Niagaras are most susceptible. Delawares seem to be most resistant; Concords are not far behind the Niagaras, and resistance to rot is not the explanation of the small amount of black rot in the Chautauqua Belt.

DISTRIBUTION

Wherever grapes are grown east of the Rocky Mountains the black rot is common and is often epidemic. In the four New York grape growing districts, the Chautauqua Belt is the least seriously affected, but even here black rot is by no means a stranger.

LOSSES

Losses from this disease vary with the season. In wet seasons there is often a total failure, while in dry ones there may be, commercially speaking, a full crop.

NAME OF THE DISEASE

The commonest name for this disease is the one indicated above, black rot. In the Keuka Lake region, however, it is often referred to as apple rot and occasionally as bird's eye.

SIGNS OR SYMPTOMS OF THE DISEASE

Black rot is very distinctive in its characters and once seen could scarcely be mistaken. On the leaves it forms reddish brown, nearly circular, distinct spots, which are from one-eighth to one-fourth of an inch in diameter, and are dotted with minute black pimples. On green shoots, leaf petioles and tendrils, black, somewhat sunken lesions are produced which may be circular or oblong and up to one-half an inch long, rarely more than half encircling the cylindrical stems. It is most characteristic on the fruit. Through July and often a part of August at irregular intervals, rot infections appear. The first appearance is a small spot having a scalded appearance occurring at almost any point on the berry (Fig. 29). This rapidly enlarges and in four or five days has involved nearly the whole berry. In the meantime the central spot turns brown and then black, and these colors follow in rapid succession over the entire berry. In ten days the berry is a hard, shriveled and wrinkled mummy.

ETIOLOGY OR CAUSE OF THE DISEASE

Black rot is caused by a fungus (*Guignardia Bidwelii* [Ellis V. and R.]). Like many other of the fungi, this fungus has several spore forms for reproduction, propagation, etc., and also like many other fungous plant parasites, has become adapted to a mode of life that conforms to that of its host.

Quantities of the mummied clusters hang to the wires or fall to the ground, and in any case the fungus which has mummified the berry lives through the winter in it, never in the ground, on weeds, posts or wires. In the spring with the advent of warm rains, the fungus becomes active and the minute pimples, which can just be seen by the naked eye, become filled with cylindrical sacs (50-100), each sac containing eight spores (Fig. 30). The spores do not all ripen at the same time and have been found as late as September. When a sac of spores is ripe, however, a drop of water on the surface of the berry, soaking in causes the sac to swell, push through the apex of the pimple (perithecium) and then discharge the spores with some violence into the air. The walls of the perithecium are relatively thick and form a complete protection. Thus it will be seen that a winter or early spring

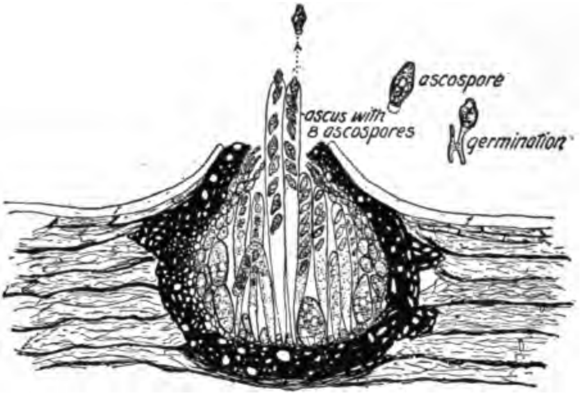

FIG. 30.—DIAGRAMMATIC SECTION OF A PERITHECIUM CONTAINING WINTER-SPORES. The spores do not all mature at the same time. Germination of the spores can be seen at the right. (Greatly magnified.)

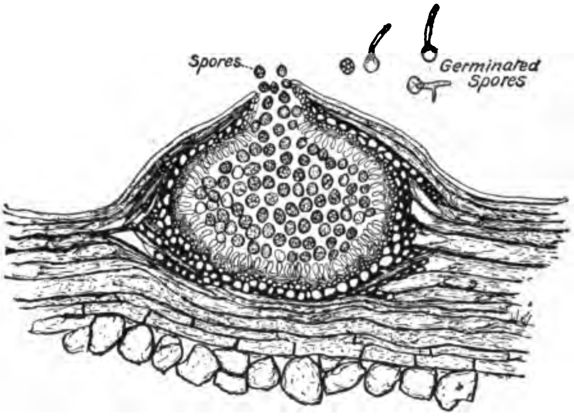

FIG. 31.—DIAGRAMMATIC SECTION THROUGH A SINGLE PYCNIDIUM, SHOWING HOW THE SUMMER-SPORES ARE PRODUCED AND HOW THEY GERMINATE. (Greatly magnified.)

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spraying has no effect on the germ of the black rot fungus. Lodging on a leaf or any green part of a vine, this spore under favorable conditions, will germinate in from twenty-four to thirty-six hours. A small germ tube is produced which makes its way into the leaf, shoot, tendril or berry and there grows and branches, killing the grape cells as it goes and eventually producing the effects described above (Fig. 32). In general then, it will be seen that in order to produce an infection there must be a rain followed by cloudy weather. Now, from the time of the rain until the time of the appearance of the characteristic spots on the various parts of the vine is from eight to sixteen days, usually ten or twelve. On this point there is no possible doubt, popular opinion to the contrary, notwithstanding.

The blackening of the berry mentioned above is an evidence that the fungus is getting ready to form its summer or propagative stage. Two weeks after the first appearance of the rot spot, quantities of minute black pycnidia are developed on the spots and over the entire berry. These contain enormous quantities of smaller oval spores which are surrounded by a gelatinous substance (Fig. 31). With a rain this gelatinous substance absorbs water, swells and forces the summer spores out of the pycnidium in a stream. Each of these spores under favorable circumstances will produce a new infection. They germinate readily in eighteen hours in rain water.

Berries which begin to rot after the first of August rarely have pycnidia containing summer spores, but develop instead pycnidia which will ultimately contain winter spores. This explains the commonly observed fact that there are not many late infections even when there are numerous early autumn rains. Late infections on leaves and shoots are rare, and true winter spores have rarely been obtained from these sources. However, it often happens that the summer spores are not all discharged during the summer, but remain in the pycnidium on the cane or tendril through the winter. The next spring they are still capable of germination and the production of infection. These are a very common source of infection, perhaps half of the early infections coming from them.

CONTROL

With these points in mind in regard to the life history of the fungus, reason for the following recommendation will be apparent. Pick the vines clean; sort in the packing house; carefully plow under all rubbish early in the spring; disbud the vines thoroughly to prevent early leaf infections from mummies on the ground.

Spray thoroughly with Bordeaux mixture. No dates can be given, since infections are dependent almost entirely upon the weather conditions, except that after August 1 there is much less danger of infection. The object in spraying is to coat all susceptible parts with a thin film of a substance poisonous to the fungus and thus prevent its growth. In order to do this the spray must be put on *before* the June and July rains. Spraying, no matter how effectively done, will be of no particular value if not done before the rains. The first application should go on when the second or third leaf has unfolded. Spraying in blossom is not harmful. To thoroughly cover susceptible parts the spray must be a *fog* spray. In order to get this, a pressure of at least one hundred pounds must be maintained, and the hole in the disk of the nozzle a one-sixteenth or one-twentieth-inch hole. Replace disks as fast as worn. This will allow for the application of sixty to seventy gallons per acre. As soon as the blossoms fall, hand spraying by means of trailers must be done in order to thoroughly cover the berries with the spray. Bordeaux mixture 4-4-50 should be used until about July 20; after that ammoniacal copper carbonate 5-3-50, in order not to discolor the fruit.

Following these methods very closely, results have been obtained which are presented in a paper by Professor Wilson. The results were very striking and conclusive to practical men even from a casual inspection.

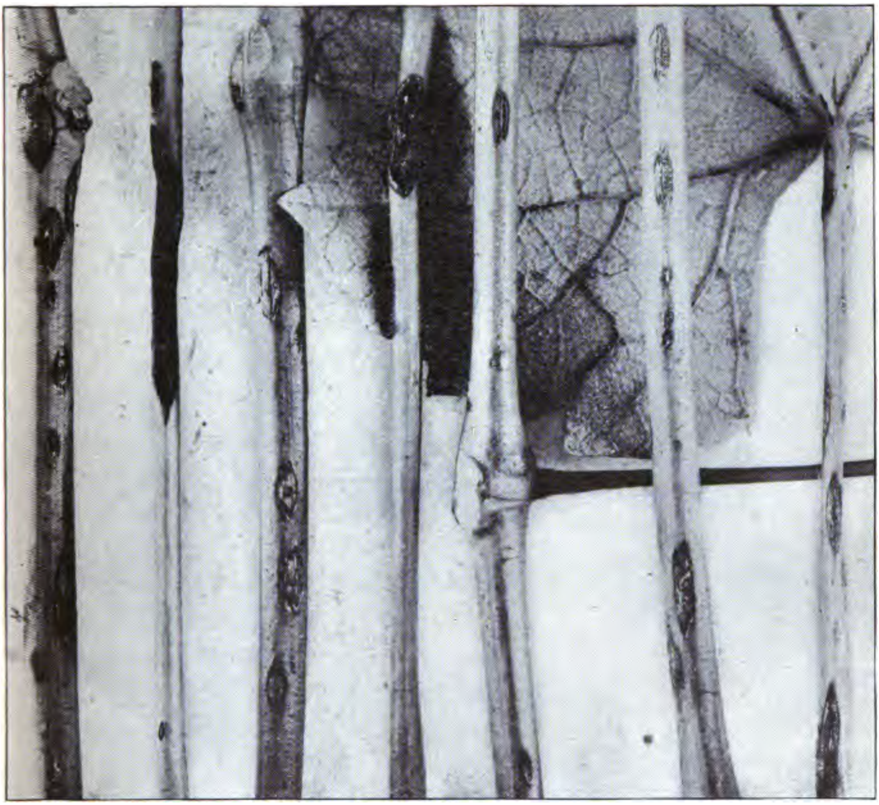

FIG. 32.— BLACK-ROT FUNGUS ON THE CANES SHOWING AS PITS AND BLOTCHES.

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Result of Experiments for Control of Black Rot of the Grape

By C. S. Wilson

Assistant Professor of Horticulture, New York State College of Agriculture at Cornell University

Spraying to control the black rot of the grape was continued during the summer of 1908. The results are conclusive and show that the black rot can be satisfactorily controlled, from a commercial standpoint, by spraying at the proper season and with the proper mixtures. A block of seven acres was chosen in the vineyard of Mr. H. B. Cushman at Romulus, a vineyard where the rot was very serious and where practically no grapes have been picked for several years, the entire crop being taken by the disease. This block was divided into seven plats, each plat having an area of one acre. The figures below, therefore, represent the yield from one acre. The different plats were treated as follows:

Plat No.	Mixture.	Strength.	No. of applications.	
1.	Bordeaux	4-4-50	6	Cultivated
2.	Bordeaux	5-5-50	4	Cultivated
3.	Bordeaux	5-5-50	6	Cultivated

4. Sprayed often according to weather conditions and cultivated.
5. Cultivated but not sprayed.
6. Neither cultivated nor sprayed.
7. Check rows (one between each plat, area one acre).

The plats were sprayed as follows:

May 29–30,
June 11,
June 18,
June 20,
July 11,
July 23, } Ammoniacal copper carbonate.
August 8, }

The grapes were picked September 25 to October 5. Records were taken of the total weight of grapes harvested. The grapes were taken to the packing house and sorted into three grades.

The results are as follows:

TREATMENT	Net weight harvested	Weight firsts	Weight wine	Weight rotten	Firsts per cent.	Wine per cent.	Rotten per cent.
1. Bord. 4-4-50, 6 applications	8,050	7,252	742¼	90¾	89.6	9.2	1.1
2. Bord. 5-5-50, 4 applications	7,873	7,461½	305	106	94.7	3.8	1.3
3. Bord. 5-5-50, 6 applications	9,158¼	8,726½	306¾	125	95.2	3.3	1.4
4. According to weather conditions	7,997	7,588	338	71	94.8	4.2	0.9
5. Cultivated but not sprayed.	3,176½	2,232½	451½	492½	70.2	14.2	15.5
6. Neither cultivated nor sprayed	3,335	2,169½	594½	571	65.	17.8	17.1
7. Seven check rows (1 acre)	4,015¾	3,072	560¾	383¾	76.4	13.7	9.6

The tabulation above shows on a commercial scale the value of the work in spraying. It does not, however, give a definite idea of the proportion of rotted clusters and rotted berries on the different plats. The tabulation below will give some idea of this proportion.

	Clusters				(a)	(b)
	Per cent. perfect		Per cent. imperfect			
	By number	By weight	By number	By weight		
1. Bord. 4-4-50, 6 applications	54.2	49.6	45.8	50.4	43.2	3.07
2. Bord. 5-5-50, 4 applications	54.3	46.	45.7	54.	57.3	3.02
3. Bord. 5-5-50, 6 applications	56.8	44.9	43.7	55.1	59.2	2.9
4. According to weather conditions.	60.	52.	40.	48.	57.6	2.04
5. Cultivated but not sprayed	14.4	18.3	85.6	81.7	9.1	13.06
6. Neither cultivated nor sprayed.	6.3	6.3	93.7	93.7	5.2	14.5
7. Seven check rows (1 acre)	1.5	8.	98.5	99.2	2.9	16.

a Per cent. of imperfect with one rotten berry.
b Average number rotten berries per cluster on imperfect clusters.

RESULT OF BLACK ROT EXPERIMENTS IN 1908

Plat No.	TREATMENT	Net weight harvested	Weight firsts	Weight wine	Weight rotten	Firsts per cent.	Wine per cent.	Rotten per cent.
		lbs.	*lbs.*	*lbs.*	*lbs.*			
1	Bordeaux 4-4-50, 6 applications	8,084	7,252	742	90	89.7	9.2	1.1
2	Bordeaux 5-5-50, 4 applications	7,872	7,461	305	106	94.8	3.9	1.3
3	Bordeaux 5-5-50, 6 applications	9,157	8,726	306	125	95.3	3.3	1.4
4	Sprayed according to weather conditions	7,997	7,588	338	71	94.9	4.2	0.9
5	Cultivated but not sprayed	3,175	2,232	451	492	70.3	14.2	15.5
6	Neither cultivated nor sprayed	3,334	2,169	594	571	65.1	17.8	17.1
7	Seven check rows (1 acre)	4,015	3,072	560	383	76.5	14.0	9.5

CLUSTERS

	PERFECT		IMPERFECT			
	Total by number	Total by weight	Total by number	Total by weight	With one rotten berry	Average numbe rotten berries per cluster
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	
1. Bordeaux 4-4-50, 6 applications	54.2	49.6	45.8	50.4	43.2	3.07
2. Bordeaux 5-5-50, 4 applications	54.3	46.	45.7	54.	57.3	3.02
3. Bordeaux 5-5-50, 6 applications	56.8	44.9	43.2	55.1	59.2	2.9
4. Sprayed according to weather conditions	60.	52.	40.	48.	57.6	2.04
5. Cultivated but not sprayed	14.4	18.3	85.6	81.7	9.1	13.06
6. Neither cultivated nor sprayed	6.3	6.3	93.97	93.7	5.2	14.5
7. Seven check rows (1 acre)	1.5	.8	98.5	99.2	2.9	16.

Home Sanitation

By H. A. Harding
Bacteriologist, New York Agricultural Experiment Station

In the institute effort our attention has been almost exclusively directed toward questions of making our farming more profitable and along this line we have had a fair measure of success. After all, our money will do us little good unless we and our families are blest with good health, and it is eminently fitting that for a few minutes we consider some of the things which vitally affect the health of the farmer and his family.

We are a very practical people and our ideas grow up in interesting ways. Some years since we became interested in the ventilation of our cow stables and the institute men went up and down this State urging the necessity of purer air for our cows. The results have been gratifying, and in the newer stables and in many of the old ones, there is evidence that the advice has been heeded. As a rule, our cow stables have purer and better air than they did a few years ago.

Then the poultry men took up the refrain, saying that what was good for the cows would be good for the chickens, and for the past few seasons they have been dilating upon the advantages of having adequate ventilation in the hen houses.

In presenting the subject of the ventilation of farm buildings to the audiences at institutes, the condition of the halls frequently offered so good an illustration of the lack of proper ventilation that public attention has gradually been directed to the idea that what was so good for the cows and the chickens might with profit be applied to the housing of human beings.

The analogy between our houses and our cow stables holds in another particular; those of a couple of generations ago were built with too much ventilation. The wind came in at many crevices and swept up the large chimney so briskly that we were roasted on one side and frozen on the other. Just as has been the case with the stables the modern houses have been built much tighter. The fireplaces have been omitted in the newer houses and boarded up in the old ones, and our heat comes from stoves or furnaces, neither of which add much fresh air nor carry off much of that which has already been used. Fuel has become expensive and we have guarded against the introduction of any fresh air because it was cold and required to be warmed. We have saved money on coal and wood and spent it on drugs and doctors.

There is no better illustration of the evil effects of a lack of fresh air than the average evening session of a farmers' institute. By that time most of the air in the room has been used several times over. The room fills up with people and the air they breathe goes to the ceiling because it is warmer than the air in the room. As you rise to address the audience you feel your head going up through progressively worse and worse layers of air. By the time you have talked twenty minutes your head feels as though it would burst and your enthusiasm and ideas have all been lost. To make the matter worse, the bad air has accumulated and settled down to the level of your audience, causing them to lose interest in what you are trying to say and putting them to sleep. Poor ventilation in public meetings is not restricted to farmers' institutes; it is also responsible for many a poor sermon and many a drowsy deacon.

The stimulating effect of fresh, pure air is in sharp contrast to that of close, bad air. When one steps out of a poorly ventilated room into the open, the air fairly tastes good and one feels revived. However, the effects of bad air are not over as soon as one is out of it. The tendency to dullness and headache persists. Where one is constantly in a close atmosphere, as is the case too often with the wife at home, there is a gradual lowering of the bodily vigor and one is less able to throw off the attacks of various diseases. Good illustrations of the value of fresh air in improving the general health is the treatment for tuberculosis in sanitariums and the marked effect of camping in the open or in tents.

The sanitarium treatment for tuberculosis is confined almost entirely to good feeding, rest and an abundance of fresh air. In this way the bodily vitality is raised and the body is able to successfully combat the disease which is preying upon it. If fresh air is such an efficient aid in combating a diseased condition of the body, it is equally valuable in preventing the inroads of disease by helping to keep the body in condition to combat the disease. The work of the farmer calls him into the open air so much that his is one of the healthiest of occupations and he is among the longest lived. Unfortunately the same cannot be said of the farmer's wife.

There is as yet no satisfactory system of ventilating the living rooms except the simple one of opening windows. I am sure that if the benefits of fresh air were fully understood, the windows would be opened in our houses more frequently than is our present practice.

One-third of our lives is spent in bed, and while there we can markedly increase our contact with fresh air and improve our health without materially interfering with our comfort. How we did sleep in the attic room where the snow would occasionally sift in, and how we did hate to get up in the cold in the morning. Like other good things, a good night's sleep is not to be had without running the risk of some discomforts. However, if there are enough covers to insure warmth, a cool sleeping room is much to be preferred, provided the coolness means fresh air. Our thanks are due to the chicken men for finding that a cloth allows the air to pass through and at the same time retains a considerable proportion of the heat. A piece of factory cloth tacked over the outside of the window, in the same general way that a mosquito netting would be put on, will enable one to have fresh air in his sleeping room without the low temperature and drafts which are so disagreeable when windows are opened in winter. I gave this matter a trial during practically all of last winter. There was no source of heat in my sleeping room aside from what would enter from an adjoining room, which was only slightly heated, and yet with a window wide open all night it was only on a few mornings that the room was too cold for dressing comfortably. I may say that this result was not what I had expected and came as an agreeable surprise. In spite of the extent to which the heat was retained in the room, there seemed to be perfect ventilation and the air was as fresh at all times as could be desired. With this arrangement there was no trouble from the beating in of rain or snow, and the window was left open practically all of the time without any occasion for anxiety on this account. This is a feature which will appeal to the careful housewife.

I used for this purpose a so-called factory cloth of a slightly closer weave than cheesecloth. It cost six cents a yard and two yards were ample to cover a window. The common mistake is to get too heavy a cloth, which will keep the room too warm during the milder weather. Even this thin cloth which I have mentioned will be too heavy as soon as the warm weather comes in the spring. This is a plan of ventilation which can be applied to practically any sleeping room and is worthy of a trial by every one of you.

Another question which is closely connected with the health of rural communities is that of sewage disposal. In many diseases, and particularly with typhoid fever, tuberculosis and dysentery, the human excretions contain large numbers of the disease organism, and if these are so disposed of as to come later in contact with healthy individuals, serious results may and often do follow. In an instance which came under my observation, one of the victims of the Ithaca epidemic came for a visit at the farm home for a few days just preceding an attack of typhoid fever. The disease soon appeared in the family on the farm and continued to attack the family and the farm help for nearly two years until there had been eleven cases and two deaths. The fact that there was direct connection between the privy vault and the well was shown by analysis of the well water. Another source of water was provided and there has not been a case of typhoid on that farm since that time. This unsanitary connection between the well and the vault had undoubtedly existed for many years and only needed the placing of the disease organism in the privy vault to start an epidemic.

The very nature of the case demands that the closet be within a comparatively short distance of the residence and like reasons call for a well in the same general location. The result is that ordinarily they are so close that there is a real connection between them and in a large per cent. of cases, farm well water is contaminated with sewage. If it were not for this fact, typhoid fever in the country would be almost unknown. Whenever the closet vault is located within 100 feet of the well, there is danger of the existence of such connection. When you go home, measure the distance in your own case, and I think that a large number of you will find that the two are within this 100-foot limit.

While the underground connection with the well is important, there is another feature which has recently come to receive more nearly its due consideration. Many privy vaults are so constructed that the flies have ready access to the contents, and the flies have a decided tendency to vibrate between the privy and the kitchen, depending apparently upon which appeals most to their sense of smell at a given time. In the regulation form of military encampment at the time of the Spanish-American war, the closets were located but a short distance from the kitchen and mess tents. The epidemic of typhoid, which was the most serious item in that war, was demonstrated to be due to the flies vibrating in this way between the closets and the mess tents, and in so doing carrying the disease germs to the food of the soldiers. The housewife is constantly struggling to keep the flies out of the house, but with only partial success, and we can aid in protecting our health by seeing to it that there is as little opportunity as possible for flies to come in contact with disease germs which they may later leave on our food.

There are a number of workable solutions for this problem of sewage disposal and it only remains for you to decide upon the one which best fits your case. The installation of inside closets with modern plumbing is not excessively expensive and is feasible in the better class of farm houses where they are provided with sufficient heating facilities to prevent freezing in winter. The outflow can be cared for by a cesspool or by laying a system of tile drains in a cultivated field. Where this is not feasible, it is a simple matter to construct a sanitary closet in close contact with the house, provided it has a water-tight drawer into which the material is received and which is so constructed as to prevent the entrance of flies. Ashes or dry earth should be added occasionally to absorb the moisture and decrease the tendency to decomposition and bad odors. This drawer should be so constructed that it may easily be withdrawn, hauled to the field and emptied. It should be kept in mind that this material may contain the germs of disease and accordingly should be handled carefully and completely covered with soil.

The point of danger in this form of closet is the possibility of the drawer becoming leaky and allowing a part of the contents to run out upon the ground. Such a case came under my observation. When attention was called to the fact that these fluids were finding their way into the adjoining well, the lady of the house considered herself insulted by the suggestion. They had always used the water and considered it as of excellent quality. Later a mild case of typhoid fever developed in the family. This naturally led to an infection of the well and in a short time the wife was taken with typhoid fever and died. After the mischief had been done a supply of water from another source was arranged for and there has been no more typhoid fever at that house in the succeeding years.

As has already been intimated, the purity of our well water is another point which demands attention if we are to properly safeguard the health of our families. It is not enough that the water be cool, look clear and have no foreign smell. It must have all of these characteristics to be above suspicion, but it may have them and yet be infected with the germs of disease, particularly typhoid fever. This is peculiarly a water-borne disease. Not only is a pure supply of water desirable for our own use, but it is coming to be a financial asset. There are a large number of outbreaks of typhoid in the cities every year which are traced back to impure well water on the dairy farms, and any farmer who is producing milk is liable to be put out of business at any time if his water supply is not pure. The trouble in this case is not, as might be inferred, due to putting the water into the milk, but rather to the contamination which results from rinsing the milk utensils in this contaminated water. Every one of us desires pure water; the question is as to how to best get it and how to know it when we have it.

In the early settlement of the country, the people commonly used the water from streams, but with the increase in population the contamination of our streams has become so great that they are no longer used as a source of drinking water except by the unfortunate dwellers in the cities which are so situated that they cannot get anything better. The State Board of Health is now vigorously taking up the matter of the pollution of streams, and while there is little probability that many of them will ever be pure enough to make them desirable as sources of drinking water, it is to be hoped that they may be at least so far purified that fish will be able to thrive in them.

Next to streams, springs are perhaps the most primitive source of drinking water. Where they occur with uncontaminated surroundings they often furnish pure water, but as they are almost always fed in whole or in part by surface drainage, they are usually to be regarded with suspicion. Even if an examination of the water at any given time shows it to be pure, the chance of later accidental contamination in a variety of ways is always present.

At present the all but universal source of our water supply is some form of well. The simplest of these is the open, dug well. In some cases these wells tap an underground stream of water and are really a form of artificial spring, but by far the larger number receive their supply from the upper portion of the ground water, which is the collective term for the water which soaks into the soil. In other words, they are a special form of local drain and their supply is largely dependent upon the moisture which finds its way into the soil in their immediate vicinity. The area from which a well draws depends upon the level of the well water and increases as the water gets lower in the well. After a protracted drought when the water in the wells has become very low, the force with which a well draws upon any source of moisture, as a privy vault in its vicinity, is much increased, and it is also noticeable that at such times the cases of typhoid fever in the country as a whole increase steadily. Leaving out of account the large epidemics in the cities, which may occur at almost any time of year, the fall months are the ones when typhoid fever is most prevalent. While it is commonly stated that a closet within 100 feet of a well is an element of danger, it will be understood from what has just been said that in cases where the water level is unusually low, trouble may arise from vaults which are even farther away.

While no one desires sewage as a constant component of his drinking water, it should be understood that the use of such water will not induce typhoid fever or any other specific disease unless the particular germ causing the disease actually finds its way into the well. The soil layers through which this liquid passes in reaching the well act as a filter which may remove the germs completely or in part. Different kinds of soil behave differently in this respect. Sand allows the fluids to pass through most readily, but it is of such an even texture that it is a very efficient filter. Solid clay is almost impervious to water and a privy vault dug in such material will not drain itself. The fact that such a vault does drain indicates that there are rifts of sand or gravel in the clay. In the case of gravel it becomes a drain rather than a filter and often little or no filtration occurs. Under such circumstances the germs from the sewage will pass directly into the well, even at comparatively long distances. As has already been said, such a condition may and often does go on for years without any apparent bad effects until some typhoid or other diseased material is deposited in the vault. Then the results often come with quickness and with crushing force.

The safest wells are those driven to considerable depths and so constructed that there is little probability of the surface drainage following down the outside of the pipe. While they may receive some of the surface drainage, this will be so diluted by the normal ground water and be so well filtered by its long trip through the soil that in most cases it will be safe for domestic use.

In speaking of sewage it was intimated that there were good reasons why the closet should be in close contact with the house. If advantage can be taken of a windmill or of a gas engine to force an ample supply of water to the house, additional security may be obtained by locating the well at some distance. The presence of such a constant supply of water will not only save labor in the kitchen, but will make possible an inside closet, hot and cold water and a regular bathtub. The washtub and the kettle of water from the kitchen stove, as a source of a bath, did their work effectively when they were used, but the inconvenience of their preparation was such that they were not called into play as often as was really desirable. In putting in these improvements which are to mean so much to the health and comfort of the home, care should be given that the work is not all undone by locating the cesspool or the drain leading to it in such a way as to contaminate the well.

We are constantly wishing that we had an accurate measure of the healthfulness of the water which we are using daily. The State has a laboratory at Albany under the direction of the Department of Health where such examinations of water are made from wells which are considered dangerous, when the sample is sent by the local health officer. Before sending the sample of water it will be necessary for him to apply for and obtain a sterilized bottle and a suitable blank to be filled out in connection with taking the sample. In this way it is possible for any one to know as to the safety of their own water supply.

The Farm Woman

By Martha Van Rensselaer

Lecturer in Home Economics, New York State College of Agriculture at Cornell University

Every rural community has its group of young women asking what is in store for them and its group of older women asking how with scarcity of help they can accomplish all their tasks. Some of the young women are stirred to aspirations for teaching, stenography or factory life where they can get away from the humdrum and monotony of household routine. Others are fascinated by the opportunities of farming for women, and others are staying at home because they are needed or have married their steady job. These women have done much for the farming of the present and the future. They are executive. They have economized and they have listened attentively to ways and means of improving farm conditions. Farming in the meantime has been "looking up." Women are still executive, economical, striving for gain in the farm finances for the sake of more land and education for the children. Standards of living have been rising and, as with other homes, the farm home has come to be regarded as a place where better conditions should prevail for the sake of the children and for the sake of the entire community whom the farmer feeds.

Men are asking that the youth be trained for farming and are trying to induce the young man to stay on the farm. They are asking for better and more permanent forms of agriculture that the people may be better and more cheaply fed. Training the farmer for his task is only half the problem. The woman on the farm is a vital part of the success of the place. The farm rises no higher than its women.

Women need education for their task as much as men. Men have long thought the "rule of thumb" was good enough for the work in the house and the care of the family, although they believed that scientific accuracy was needed for tilling and feeding out of doors.

Women need the inspiration and uplook of intelligent service, of scientific methods, of artistic accomplishment in even very practical affairs.

Much is said about the improvement of the raw material. What is the use of it all if women are not trained for the selection and preparation of the raw material?

Housekeeping is behind the times. The house has the poorest workshop of any industry in existence. Here is needed the cooperation of men. The same masculine inventive genius which brought water to the barn is needed to bring it to the house; to attach the power to the washing machine which is used on his saw or threshing machine. Men have carried a certain business calculation into their farming which prevents their using worn out, out-of-date tools and equipment; the same business thrift should prevent unhandy conditions in the kitchen and lack of labor-saving devices. Farmers do not want their sons to work in the way they and their fathers worked; neither can they afford to allow their wives and daughters to work under such disadvantages as the old-time kitchen presented.

Millions of dollars are spent in the United States every year for domestic service. This includes large amounts not only for wages, but for waste and for food. Until this amount is safeguarded by training and intelligence, wasted effort and wasted material will contribute to the high cost of living.

Is the rural community ready for education in nutrition, sanitation, household management? The rural women have more varied problems than have urban women, hence a larger need. They have had their attention called to scientific terms in farmers' institutes until protein, carbohydrates and calories are household terms. Bacteriology is a familiar ground upon which to base the study of better health in the family. It is natural that farm women should be the first exponents of the new doctrine of domestic health and prosperity.

Our State has made an appropriation for farm home extension or education among women. I hope that New York State is to be a leader in this work. Many states are asking how this work can be done. They are considering appropriations for making the farm home parallel in importance to the farm. Those who have lived in New York State have reason to be proud of the work that has been done here. As this wave of enthusiasm is going over the country for better homes, for education in the home, for placing homes on a scientific basis, New York State should take the lead.

If we believe the signs of the times, the farmers' institute is a great educational factor in rural districts. New York State had the first reading course for women under state appropriation in the country. It had the first woman's institute in the United States. This was held in the Adirondacks under the auspices of the Department of Agriculture assisted by the Department of Agriculture at Cornell University. New York is among the first of the states to have the winter course for home economics. It should furnish the best material in farmers' institutes for improving the home. We have had an appropriation before other states had it, and the question comes, Shall we drop behind the western states or keep in the lead?

We recognize the fact that the men who are working in the institutes are doing a splendid work in teaching the adult people of the country. In your institutes there are young men and young women needing inspiration, direction, incentive. We want more intelligent men and women in the homes. More intelligent women, who will not say that they do housework because they cannot get out of it. We have splendid young women in this State who do not know what to do with themselves. Almost every woman must have something to occupy her attention outside of home duties. We do not want women who are always complaining that woman's work is never done; men have to eat three times a day; this house is never clean; the maid is away, etc. The man on the farm does not go about complaining of his hired man. We must prevent women from feeling that they are machines, goods or chattels; they must believe they are a part of the economy of the household and a progressive part. Institutes should help girls to feel that they should have a different attitude towards housework and the farm home.

If a man went out to institutes this year and feels that he inspired his neighbors for better ideals and for better conditions he has done more than to earn his salary.

What Shall the Farmer Read?[a]

By F. H. Hall

Editor and Librarian, New York Agricultural Experiment Station

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Millet, in his "Man with the Hoe," has painted a farmer who does not read; and Markham in his poem has voiced the condition of this same luckless creature. He stands before us in both picture and poem, a thing little better than the beasts — a mere machine to whom Nature's "sermons in stones, books in running brooks and good in everything" do not appeal, and from whom have gone, if ever he possessed them, both desire and ability to gather instruction, uplift or pleasure from the stored thoughts of other minds. By some this forlorn peasant has been thought a fitting type of the farmer of to-day. Even Hawthorne tells us: "The yeoman and the scholar, the tiller of the soil possessing the sturdiest sense, integrity and honor, and the man of finest intellectual culture are, and must remain, two distinct beings."

But we hold that Millet's painting and Markham's poem typify exceptional conditions. There may still be somewhere in small numbers, farm laborers or even farm owners, whose thoughts do not rise high above soil and stable, and whose lives of daily toil and routine, without books or other stimulating influences, have made them mere living attachments of the plow; but this is not true of the modern American husbandman. He is a thinker, a student of his own problems, an interested observer of the world's life, a dependable and helpful citizen when need calls, and often a man of culture as true and deep as that of the dweller in cities. Farm life need never deaden the finer sensibilities nor check high aspirations, even for literary expression. Vergel, the great Latin poet, was a farmer; Burns at the plowtail composed those songs that still stir the hearts of men; Whittier in the hayfield was moved to thoughts whose expression heralded freedom for the slave; Thoreau in his little bean patch conceived nature pictures that please; Webster, Lincoln, Garfield, in their humble farm homes, found time to cultivate the taste for books which all their hard farm labor could not quench.

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[a] This paper is a revision of an address included in the Report of Farmers' Institutes for 1902, with the addition of a list of books.

THE FARMER MUST READ

The American farmer of these opening years of the twentieth century is not an illiterate, uncultured boor. He cannot be and succeed. He meets life at too many points where knowledge gained from wider experience than his own must come to his aid. The old distrust of "book farming" is rapidly passing; and the progressive herdsman or gardener or orchardist finds practical guidance in books dealing with the technical side of his craft. With all humanity, he may reason with the philosopher, laugh with the humorist, thrill at the vivid pictures of the novelist, smile or sigh with the poet or feel his aspirations mounting high under the spell of the preacher's words, as the thoughts of some of these intellectual masters become his own through the lines of the printed page. So we might dismiss the question, "What shall the farmer read?" by saying that he should, and can, and does, and will, read and understand and appreciate any book which is worthy the thought of other men. But the mass of published literature is great, and the farmer, by his comparative isolation, is separated from librarians, critics, teachers and others who have greater leisure than he, to read, compare and select books; so he frequently reads much without value, merely because he does not know of that which is better or, appalled by the mass of books, fails to read any. This last is a fatal error; for he who fails to read good books misses a part of life nothing else can replace. This is particularly true of those whose lives must be spent on farms; for by their separation from their fellows they can less easily avail themselves of other means of culture whereby the dweller in cities, though not a reader, may to some extent secure the mental training given to him who reads thoughtfully the best books.

BOOKS NECESSARY FOR CHILDREN

The children of the farm home need books. Beecher says: "No man has a right to bring up his children without surrounding them with books. It is a wrong to his family. He cheats them. Children learn to read by being in the presence of books. The love of knowledge comes with reading and grows upon it, and the love of knowledge in a young mind is almost a warrant against the inferior excitement of passions and vices. A little library, growing larger every year, is an honorable part of a young man's history. It is a man's duty to have books. A library is not a luxury, but one of the necessities of life." Were more country homes supplied with interesting reading, there would be less occasion to raise the question, "How shall we keep the boys on the farm?" Even one good magazine or paper like *St. Nicholas* or *Youth's Companion* coming regularly into the house will be a tie most boys will consider before leaving the home nest to "become pirates," "hunt grizzlies" or "kill Indians." These juveniles of better class will establish the children's tastes and prevent their finding supreme enjoyment in cheap, flashy literature which has to be read secretly, out behind the barn or in their rooms with doors closed and lights low. These should be followed by more solid magazines, studying the child's taste, if necessary, to lead him on; but he will usually soon take up the periodicals in which he sees his parents interested and from them will pass quickly and easily to the best and solidest books.

The occasional arrival as a birthday or Christmas gift of a new book like Thompson-Seton's *Wild Animals I Have Known,* Bailey's *Lessons with Plants,* Gibson's *Sharp Eyes,* Blanchan's *Bird Neighbors* or others of the nature study class will waken the wits of boys or girls, if they have any, and inspire a love for country life that it will take many city attractions to overcome. A good story by Castlemon or Alger or Henty, while not of great literary merit, will teach good morals and develop respect for courage and honor. They can do the sensible boy no harm, and their charm will fill him with disgust for the low pleasures of the corner grocery, billiard room or saloon. The *Man from Glengarry* cannot help but appeal with power to the manly qualities of any country youth.

BOOKS AID FARM PRACTICE

The farmer needs books which treat of the farm. The days have long since passed when he could turn over the fertile soil and, weather permitting, reap a bountiful crop without opposition from insects or disease. He can no longer send his cattle into the rich meadows or hill pastures, toss them a generous supply of easily raised corn and corn-stalks at stabling time and make a profit on the resulting milk and beef. Soils have lessened in fertility, enemies have come to grain and fruit, competition forbids wastefulness of every kind if cultivation and feeding are to bring profits. In the old days, a good vigorous body employed in faithful work along well-known broad lines was all that was needed to earn Nature's bounty; and the near field supplied the near market. Now, the farmer who depends on strength alone and treads the path his father trod must go to the wall. To succeed, he must know the principles which underlie soil fertility, he must be on the alert to meet the enemies of his crops, he must make each of his animals do the best possible on a minimum expenditure for food, he must make his profit fit to compete with the best in the world, he must market right, he must buy right.

To keep posted along these lines, books and papers are essential. Fortunately the past few years have given us a vast fund of interesting and valuable literature in the realms of scientific and practical agriculture and horticulture. The work of the experiment stations and the U. S. Department of Agriculture has given a basis of scientifically proven facts upon which to base discussions of farm problems, and the intimate studies of investigators have made them familiar with the most successful farm practices the world over; so that the recent books along agricultural lines are both accurate and interesting. The few, good old stand-bys of twenty years ago, like Allan's *Book of the Farm,* Sheldon's *Dairy Farming,* Henderson's *Gardening for Profit,* Stewart's *Feeding Animals,* Greeley's *What I know About Farming* and others of their type were most helpful and inspiring in their day, and each contains the best of a vast body of truth discovered by practical cultivators and feeders. These books should not be sneered at or passed over in silence; but they have been superseded, for the progressive farmer, by the works of Roberts, Bailey, Jordan, Voorhees, Brooks, Henry and others who emphasize principles without neglecting practices. The titles of many of these books will be found in the appended lists. (For presentation to audiences these lists might well be made in the form of charts).

The thoughtful farmer will not neglect to secure and use a file of station bulletins; for if he does he will miss many points by which his neighbor will profit. Station publications may often be somewhat technical and tedious, especially when they treat of matters in which you have no immediate interest. You should preserve complete files of the bulletins of your own stations — the State Station at Geneva and the Cornell University Station at Ithaca. These cost you nothing and require only small storage room; and when they are applicable to your conditions their guidance is valuable, for it rests on conscientious, careful work of trained investigators. When your favorite farm paper mentions a bulletin of interest from some other station, write a courteous request for it to the director of that station. You will be almost certain to get it if the edition is not exhausted; and very few stations make any charge for their bulletins even to those not in the State.

Also, you should keep track of the publications of the U. S. Department of Agriculture. Its work of late years has, as a whole, been careful, thorough and often of great value, although a few of the theories announced have not been accepted by other scientists or the methods recommended given in practice the results hoped for. The Department will, if you request it, send each month a list of the publications issued in that month, with a brief indication of their character. Many of these publications, especially the farmers' bulletins and the yearbooks, are free and the others cost but a few cents apiece. Your congressman or senator can usually secure these for you without expense.

You must, of course, have a good farm paper or two; for these are now most valuable aids to the farmer, not only in raising his products, but in guiding him when they are ready for market. So many good papers are published, even in New York State alone, that you can hardly fail to secure a valuable adviser, whatever one you choose. *Country Gentleman, Rural New Yorker, American Agriculturist, New York Tribune Farmer,* each is good in its chosen field and style; while from outside the State come *Breeder's Gazette, National Stockman, Hoard's Dairyman, Farm Journal, Agricultural Epitomist, Homestead, Farm and Fireside* and a host of others of greater or less value and applicability.

The choice, if you are not already well supplied, should be made with care after sending for sample copies and studying them carefully to see which of them best meet your needs.

FARMER SHOULD READ FOR GENERAL INFORMATION

Books for the children, then, and practical guides to thorough understanding of the farm and its operations are absolutely essential, but the library should contain more than these. The farmer of to-day, with milk to carry to creamery, cheese factory or shipping station in the morning, and herd to look after in the evening, with feed and fertilizers to haul from market, with poisons and preventives for bugs and blights to mix and to apply, with grange meeting or farmers' club to attend, may not have the leisure his father had forty years ago. He fed his horses in the morning, plowed with them until the sun was low, gave them their corn or oats and counted his day's work done; but when you have crowded into the hours between sunrise and sunset their allotted share of the multitudinous details of modern farm activity, you will still have some time to read. Winter evenings are long and Sunday afternoons are quiet. What, then, should you have in your library? Tastes differ; and some of the books that appeal to me might weary many of you with scientific terminology and uninteresting researches, while others that serve as my relaxation to some of you might seem too light and frivolous for serious consideration. Yet there are some books or some classes of books that can be recommended for all, some neglected, some rejected. The human heart beats at about the same rate on the farm as in the city; the mind of the reasoning man wherever he may be responds to about the same appeals; hopes and fears, sentiment and sentimentality, pain and passion, as expressed on the printed page by some master hand, will stir corresponding emotions in the breast of the reader, whether he be seated beside the fire in the farm kitchen or reclined at ease in a luxurious city study.

First, it appears to me, the farmer and his family should read the Bible. Even if you can not subscribe to all its teachings — or to what you may have learned to think it teaches, from interpretations put upon it by others — you can not afford to neglect its pages. You will find between its covers the best guide to morality the world knows; history that has influenced civilization as that told in no other volume; biography for warning, for example, for inspiration; poetry as beautiful, as majestic, as heart-thrilling as any in the world's literature; all expressed in "pure English, undefiled," a model of correctness and strength.

Next, the library should be started with a well-known book — one appearing in many editions, revised and corrected, abridged and expanded by many authors — a book of short stories, some thrilling, some prosy, but all true, suggestive and helpful — the dictionary of the English language. Without this book in some good form and its companions, the atlas and encyclopedia, constantly at hand and consulted faithfully, you may miss the best, and certainly will miss something of the other books you read.

You will require a good newspaper, but you must learn to read it properly, to discriminate without waste of time between gossip to be skipped, sensationalism to be discounted, and topics of local or world-wide interest to be studied with all the earnestness you possess. The magazines also demand a place in every library and every home. Through them we get the best thoughts of living thinkers in every line of human activity; in them we see through the eye of witnesses events that are shaping history; they offer us the best stories from the brightest pens, and they reproduce for us, by the engraver's art, the distant scenes we may not visit, the magnificent conceptions of the great masters in art and the pictured thought of novelist or poet.

BOOKS FOR CULTURE

This is literature for information; you must also read for general culture. Read works which broaden your horizon, deepen your intelligence, arouse in you more sincere interest in society and politics, quicken your sympathies, cultivate your artistic tastes, develop your moral fiber.

History is to most of us only a school study; for we find time to get little beyond a general knowledge of the events that have marked the advance of civilization. Our studies have probably given us only a sketch of the nations of antiquity, a little broader acquaintance, perhaps, with the literature and art of Greece, with the principles of warfare and lawmaking of the Romans, a hasty glance at the Middle Ages, Chivalry and the Crusades, a little keener scrutiny of England's development, since this bears so closely on our own, and probably a fair idea of men, events and principles marking the rise of our own glorious Republic to the foremost place among the nations of the world. Based on this broad foundation, which each should have or should exert himself to secure, we can never read too widely in history. As we become more and more familiar with the interplay of forces, note the principles and practices which have uplifted or cast down leaders and kingdoms, see how some obscure man or some apparently trivial event has changed the course of nations, we not only become broader ourselves, but we realize more clearly how thoroughly interwoven are the interests of the individual with the interests of humanity. Among the writers of histories, the names of Gibbon, Greene, Macaulay, Hume, Grote, Motley, Bancroft, Fiske, Lodge stand prominent, but to select the particular ones for a library is a question of individual judgment and well-considered study. Here, as in the other departments of literature for culture, you may well avail yourself of the friendly counsel of your pastor, school superintendent and teachers, the librarian of the nearest city library or some other friend whose time has allowed more leisure for study of books than has your own.

Most intimately connected with history is biography; for the life and progress of a nation can often be told in the lives of a few of its leaders in thought and action. Such lives have more of personal interest than the pages of history, and we find in the perusal of their record that which instructs and inspires us. No American can be his best until he has read and made part of his life the biographies of Washington, Ethan Allen, Benjamin Franklin, Lincoln, Greeley, Webster, Garfield and their noted compatriots.

Yet history and biography do not show us the heart of the world. They are too formal, we might almost say too philosophical, to picture the real life with its events which move from day to day rather than from age to age, or even year to year. To feel the incidents of human life we must read the literature of the drama or the novel, whose characters move, love, hate, plot, prosper, fail or die in our minds almost as truly as though they were our companions. From the pages of *Ivanhoe* we get more vivid ideas of the life and manners and conditions of that age than from the pages of Macaulay. In Shakespeare's *Caesar* we see a more real conquerer, feel more deeply the power of his mind, realize better the vastness of his triumphs, understand more clearly the fear and envy he aroused, learn more of the motives which moved the Roman mind than we could from any formal relation of his deeds and experiences. In *Hugh Wynne* or *Janice Meredith* or the *Seats of the Mighty,* clearer pictures of our country's early conflicts are fixed upon our minds than come to us from the pages of Bancroft or Ridpath. Mrs. Stowe's *Uncle Tom's Cabin* showed the north the wrongs of the negro as would no calm discussion of the ethics of slavery. *The Jungle* undoubtedly assisted materially in promoting reform in slaughter-house conditions.

In thus supplementing history, fiction and the drama do not exhaust their value. This is greatest in their influence on the spirit and character of the reader. He must be a better man who has known *John Halifax,* a more courteous gentleman, he who has admired *Colonel Carter;* he will become less fretful under petty cares who recalls *Mark Tapley's* merry laugh or *Colonel Sellers's* optimism; he will less easily succumb to difficulties who has followed the career of *Peter Sterling.* That woman will have a broader and purer mind, a sweeter spirit, more of sympathy, less of harshness, who has lived mentally with *Agnes Copperfield,* George Eliot's *Dinah, Jeanie Deans, Babbie, Meh Lady, Janice Meredith* or *Diana Mallory.*

As fiction makes familiar to us scenes from other times, makes real to us characters of robust worth, makes to live for us and in us sentiments of which our real lives may be bare, so poetry trains the imagination that it may clothe with beauty the humblest scene. *The Cotter's Saturday Night* has changed the thatched roof of many a lowly cottage to a thin division between the heaven above and its earthly counterpart — a loving, contented home. It has been said and truly, that "A single poem that warms the affections, elevates the soul, excites the imagination, kindles the emotions and arouses noble aspirations may be worth more to myriads of readers than a whole library of fact, argument, exhortation or edification."

SUMMARY

For your library, then, you should select at least a few good books, among the thousands, in each of the classes I have named. The Bible with a good concordance and Bible dictionary and a few of the best, most uplifting religious books — do not depend on Baxter's *Saints Rest,* Bunyan's *Pilgrim's Progress,* Young's *Night Thoughts* and a few other old standbys probably inherited from your good old grandmother — dictionary, encyclopedia and atlas, a few of the modern, thought-compelling works on the farm and farming, bulletins, a good agricultural paper, a newspaper or two, a story paper, books of nature and an occasional romantic tale for the boys and girls, magazines, history, biography, travels, social science, Shakespeare, some of the best novels and your favorite poets. With such a collection you have started a library no one need be ashamed of and one which will furnish aid and inspiration for all the household. Read them, think of them, add to them, and with the coming years you will find in them satisfaction far outweighing any sacrifice you may have made to secure them.

GOOD BOOKS FOR A FARM LIBRARY

In preparing this list it has been the endeavor to include one or more books upon each topic of special interest upon the farm or in the rural home. While intended to be comprehensive, it can only include one book here and there among the thousands published along these lines; and while care has been used in making the selection, it is not impossible that better books have been omitted than are included. It is believed, however, that no book has been listed that will not be helpful to its reader and well worth its price if properly used. In most cases, the publisher and place of publication are given, but practically all of them can be secured through the publishers of farm papers, like the *Orange Judd Co.,* New York City; *Luther Tucker & Son,* Albany; *The Rural Publishing Co.,* New York; *The Macmillan Co.,* New York, or the *Tri-States Publishing Co.,* Port Jervis.

Agriculture

(The general subject.)

Cyclopedia of American Agriculture. Edited by L. H. Bailey. New York: Macmillan. 4 vols. $20.00

Farmer's Cyclopedia of Agriculture. Wilcox and Smith. New York: Orange Judd Co.	$3.50
Agriculture. Brooks. Springfield, Mass.: King-Richardson Co. 3 vols.	
How the Farm Pays. Henderson and Crozier. New York: Orange Judd Co.	$2.00
The Farmstead. Roberts. New York: Macmillan.	$1.25
How to Choose a Farm. Hunt. New York: Macmillan.	$1.75
Principles of Agriculture. Bailey. New York: Macmillan.	$1.25
The New Agriculture. Wallace. Philadelphia: Lippincott.	$1.25
First Principles of Agriculture. Voorhees. Boston: Silver, Burdette & Co.	$1.00
First Principles of Agriculture. Mills and Shaw. Toronto, Canada: Bryant Publishing Co.	$0.40

Agricultural Chemistry

Agriculture in Some of Its Relations with Chemistry. Storer. New York: Orange Judd Co. 3 vols.	$5.00
How Crops Grow. Johnson. New York: Orange Judd Co.	$2.00
How Crops Feed. Johnson. New York: Orange Judd Co.	$2.00
Chemistry of Soils and Fertilizers. Snyder. Easton, Pa.: Chemical Publishing Co.	$1.50
Chemistry of Plant Life. Snyder. New York: Macmillan.	$1.25
Chemistry of the Farm. Warington. New York: Orange Judd Co.	$1.75
Practical Farm Chemistry. Greiner. New York: Rural Pub. Co.	$1.00
Organic Compounds of Every Day Life. Willard. Manhattan, Kans.: Author.	
Chemistry of the Garden. Cousins. New York: Macmillan.	$0.35

Meteorology

Talks About the Weather. Barnard. New York: Funk & Wagnalls.	$0.75
Elementary Meteorology. Waldo. New York: Scribner.	$1.25
Story of the Atmosphere. Archibald. New York: Appleton.	$0.40

Agricultural Botany

Lessons with Plants. Bailey. New York: Macmillan.	$1.10
Plant Breeding. Bailey. New York: Macmillan.	$1.25

Agricultural Botany. Percival. London: Duckworth & Co. $2.00

How to Know the Wild Flowers. Dana. New York: Macmillan. $1.75

Plant Relations. Coulter. New York: Appleton. $1.50

Familiar Flowers of Field and Garden. Mathews. New York: Appleton. $1.75

Bacteriology

Agricultural Bacteriology. Conn. Philadelphia: Blakiston. $2.50

Outlines of Dairy Bacteriology. Russell. Madison, Wis.: Author. $1.00

Practical Dairy Bacteriology. Conn. New York: Orange Judd Co. $1.25

Bacteria in Relation to Country Life. Lipman. New York: Macmillan. $1.50

Agricultural Zoology

Agricultural Zoology. Ritzema-Bos, translated by Davis. London. Can be obtained through G. E. Stechert, New York.

How to Rid Buildings and Farms of Rats, etc. "Pickett." New York: Rural Pub. Co.

Life of Animals. Ingersoll. New York: Macmillan. $2.00

Bird Life. Chapman. New York: Appleton. $1.75–3.75

Wild Animals I have Known. Thompson-Seton. New York: Scribner. $2.00

Sharp Eyes. Gibson. New York: Harper. $2.50

Bird Guide: I. Water Birds; II. Land Birds. Reed. Worcester, Mass.: Reed. Part, $0.50

Useful Birds and Their Protection. Forbush. Boston: Mass. State Board Agr.

Birds in their Relation to Man. Weed & Dearborn. Philadelphia: Lippincott.

How Birds Affect the Farm and Garden. Merriam. New York: Forest & Stream $ .05

Geology

The Physical Geography of New York State. Tarr. New York: Macmillan.

First Book in Geology. N. S. Shaler. New York: D. C. Heath & Co. $1.10

Soils

The Soil. King. New York: Macmillan.	$0.75
Physics of Agriculture. King. Madison, Wis.: Author.	
Vegetable Mould and Earthworms. Darwin. New York: Appleton.	$1.50
Chemistry of Soils and Fertilizers. Snyder. (See under Agricultural Chemistry.)	
Fertility of the Land. Roberts. New York: Macmillan.	$1.25
Soils. Hilgard. New York: Macmillan.	$4.00
First Principles of Soil Fertility. Vivian. New York: Orange Judd Co.	$1.00

Drainage and Irrigation

Irrigation and Drainage. King. New York: Macmillan.	$1.50
Irrigation Farming. Wilcox. New York: Orange Judd Co.	$1.50
Drainage for Profit and Health. Waring. New York: Orange Judd Co.	$1.00
Tile Drainage. Chamberlain. New York: Orange Judd Co.	$0.35
Practical Farm Drainage. Elliott. New York: Wiley.	$1.00
Irrigation for Farm, Garden and Orchard. Stewart. New York: Orange Judd Co.	$1.00

Fertilizers

Fertilizers. Voorhees. New York: Macmillan.	$1.00
Manures and Manuring. Aikman. Edinburgh, etc.: Blackwood. Sold in America by Orange Judd Co.	$3.00
Manures: How to Make and How to Use Them. Sempers. Philadelphia: Burpee.	$1.25
Fertilizers. Gregory. New York: Orange Judd Co.	$0.40
Fertility of the Land. Roberts. (See under Soils.)	
Chemicals and Clover. Collingwood. New York: Rural Pub. Co.	$0.25
Fertilizer Farming. Collingwood. New York: Rural Pub. Co.	

Field Crops

Forage Crops Other than Grasses. Shaw. New York: Orange Judd Co.	$1.00
Principles of Plant Culture. Goff. Madison, Wis.: Author.	$1.10

The Potato. Fraser. New York: Orange Judd Co.	$0.75
The New Potato Culture. Carman. New York: Rural Pub. Co.	$1.00
Soiling, Soiling Crops and Ensilage. Peer. New York: Mansfield.	$0.75
Silos, Ensilage and Silos. Miles. New York: Orange Judd Co.	$0.50
A Book on Silage. Woll. Chicago: Rand McNally & Co.	$1.00
Tobacco Leaf. Killebrew and Myrick. New York: Orange Judd Co.	$2.00
Tobacco. Ragland. Hyco, Va.: Author.	
The Book of Wheat. Dondlinger. New York: Orange Judd Co.	$2.00
Wheat Culture. Curtis. New York: Orange Judd Co.	$0.50
Soils and Crops. Morrow & Hunt. Chicago: Howard Wilson Co.	$1.00
The Book of Alfalfa. Coburn. New York: Orange Judd Co. (Condensed book by same author and publisher, $0.50.)	$2.00
Broom Corn and Brooms. Compiled. New York: Orange Judd Co.	$0.50
The Cereals in America. Hunt. New York: Orange Judd Co.	$1.75
Clovers and How to Grow Them. Shaw. New York: Orange Judd Co.	$1.00
Corn Plants. Sargent. Boston & New York: Houghton, Mifflin & Co.	$1.00
The Book of Corn. Myrick, *et al.* New York: Orange Judd Co.	$1.50
Indian Corn Culture. Plumb. Chicago: J. H. Sanders Pub. Co.	$1.00
Forage Crops. Voorhees. New York: Macmillan.	$1.50
Farm Grasses of the United States. Spillman. New York: Orange Judd Co.	$1.00
Forage and Fiber Crops in America. Hunt. New York: Orange Judd Co.	$1.00

Farm Garden and Vegetable Crops

Horticulturists' Rule Book. Bailey. New York: Macmillan.	$0.75
Garden Making. Bailey *et al.* New York: Macmillan.	$1.50
A Book of Vegetables and Garden Herbs. French. New York: Macmillan.	$1.75
Practical Garden Book. Bailey & Hunn. New York: Macmillan.	$1.00
The Fruit Garden. Barry. New York: Orange Judd Co.	$1.50
A Kitchen Garden of One Acre. Van Orman. Philadelphia: Burpee.	$0.30
How to Make the Garden Pay. Greiner. New York: Orange Judd Co.	$2.00
Vegetables for the House Garden. Compiled. Philadelphia: Burpee.	$0.50
My Handkerchief Garden. Barnard. New York: Rural Pub. Co.	$0.50
Bean Culture. Sevey. New York: Orange Judd Co.	$0.50
Cabbage and Cauliflower. Allen. New York: Orange Judd Co.	$0.50
Celery Culture. Beattie. New York: Orange Judd Co.	$0.50
The New Onion Culture. Greiner. New York: Orange Judd Co.	$0.50
Melons for Market. Van Orman. Philadelphia: Burpee.	$0.20
Rhubarb Culture. Morse & Fiske. New York: Macmillan.	$0.50
Root Crops. Burpee. Philadelphia: Burpee.	$0.20
Squashes: How to Grow Them. Gregory. Marblehead, Mass.: Author. Sold by Orange Judd Co., New York.	$0.30
Tomato Culture. Tracy. New York: Orange Judd Co.	$0.50

Farm Fruit Culture

Principles of Fruit Growing. Bailey. New York: Macmillan.	$1.25
Bush Fruits. Card. New York: Macmillan.	$1.50
Small Fruit Culturist. Fuller. New York: Orange Judd Co.	$1.00

Practical Fruit Grower. Maynard. New York: Orange Judd Co.	$0.50
Apples of New York. Beach, *et al.* 2 vols., Albany: State. (Distributed largely by members of Legislature of 1905.)	
Field Notes on Apple Culture. Bailey. New York: Orange Judd Co.	$0.75
Grape Culturist. Fuller. New York: Orange Judd Co.	$1.50
Peach Culture. Fulton. New York: Orange Judd Co.	$1.00
Plum Culture. Waugh. New York: Orange Judd Co.	$1.50
Quince Culture. Marsh. New York: Orange Judd Co.	$1.00
A B C of Strawberry Culture. Terry. New York: Orange Judd Co.	$0.35
The Biggle Berry Book. Biggle. New York: American Garden Co.	$0.50

The Flower Garden

Flowers: How to Grow Them. Rexford. Philadelphia: Penn Pub. Co.	$0.50
Gardening for Pleasure. Henderson. New York: Orange Judd Co.	$1.50
House Plants and How to Succeed with Them. Hillhouse. New York: Orange Judd Co.	$1.00
Pansies, Poppies and Sweet Peas. Hutchins. Philadelphia: Burpee.	$0.10
Bulbs and Tuberous Rooted Plants. Allen. New York: Orange Judd Co.	$1.50
Chrysanthemum Culture. Morton. New York: Orange Judd Co.	$1.00
The Rose. Ellwanger. New York: Orange Judd Co.	$1.25

Farm Pests and Their Repression

Insects Injurious to Fruits. Saunders. Philadelphia: Lippincott.	$2.00
Insects and Insecticides. Weed. New York: Orange Judd Co.	$1.25
Economic Entomology. Smith. Philadelphia: Lippincott.	$2.50
Insects Injurious to Staple Crops. Sanderson. New York: Wiley.	$1.50

Insects Injurious to Vegetables. Chittenden. New York: Orange Judd Co.	$1.50
Plant Diseases. Massee. New York: Macmillan.	$1.60
The Spraying of Plants. Lodeman. New York: Macmillan.	$1.00
Spraying Crops. Weed. New York: Orange Judd Co.	$0.50
Fungi and Fungicides. Weed. New York: Orange Judd Co.	$1.00

Bee Keeping

A B C of Bee Culture. Root. Medina, O.: Author.	$1.20
Manual of the Apiary. Cook. New York: Macmillan.	$1.25
Quinby's New Bee Keeping. Root. New York: Orange Judd Co.	$1.00
The Hive and Honey Bee. Langstroth. New York: Orange Judd Co.	$1.00

Live Stock

Farmers' Cyclopedia of Live Stock. Wilcox & Smith. New York: Orange Judd Co.	$4.50
Cyclopedia of Agriculture. Bailey. Vol. III. (See under Agriculture.)	
Feeds and Feeding. Henry. Madison, Wis.: Author.	$2.50
Feeding of Animals. Jordan. New York: Macmillan Co.	$1.25
The Care of Animals. Mayo. New York: Macmillan Co.	$1.25
Farmers' Veterinary Adviser. Law. New York: Orange Judd Co.	$3.00
Handbook for Farmers and Dairymen. Woll. New York: Wiley.	$1.50
Animal Breeding. Shaw. New York: Orange Judd Co.	$1.50
Stock Breeding. Miles. New York: Orange Judd Co.	$1.50
The Breeds of Live Stock. Sanders. Chicago: J. H. Sanders Pub. Co.	$2.00
The Horse. Roberts. New York: Macmillan.	$1.25
Hints to Horse Keepers. Herbert. New York: Orange Judd Co.	$1.50
Horse Breeding. Sanders. Chicago: J. H. Sanders Pub. Co.	$1.50

The Family Horse. Martin. Chicago: J. H. Sanders Pub. Co. $1.00

Winter Care of Horses and Cattle. Terry. New York: Orange Judd Co. $0.35

American Cattle. Allen. New York: Orange Judd Co. $2.50

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Shepherd's Manual. Stewart. New York: Orange Judd Co. $1.00

The Sheep. Armatage. London: Warne. $1.00

Swine Husbandry. Coburn. New York: Orange Judd Co. $1.50

The Pig. Harris. New York: Orange Judd Co. $1.00

Home Pork Making. Fulton. New York: Orange Judd Co. $0.50

Dairying

American Dairying. Gurler. New York: Orange Judd Co. $1.00

Dairy Science. Woll. New York: Wiley. $1.50

Milk and Its Products. Wing. New York: Macmillan. $1.00

Principles of Modern Dairy Practice. Woll. New York: Wiley. $1.25

Profitable Dairying. Peck. New York: Orange Judd Co. $0.75

Keeping One Cow. New York: Orange Judd Co. $1.00

Chemistry of Dairying. Snyder. Easton, Pa.: Chemical Pub. Co. $1.50

Modern Methods of Testing Milk and Milk Products. Van Slyke. New York: Orange Judd Co. $0.75

Buttermaking. McKay & Larsen. New York: Wiley.

Creamery Butter Making. Michels. Lansing, Mich.: Author. $0.75

Milch Hygiene. Jensen. Philadelphia: Lippincott.

Dairy Bacteriology. Conn. (See under Bacteriology.)

Cheese Making. Van Slyke & Publow. New York: Orange Judd Co.

Poultry

Farm Poultry. Watson. New York: Macmillan. $1.25

The Business Hen. Collingwood. New York: Rural Pub. Co. $0.75

Low Cost Poultry Houses. Darrow. New York: Orange Judd Co. $0.25
Poultry Architecture. Fiske. New York: Orange Judd Co. $0.50
Turkeys and How to Grow Them. Myrick. New York: Orange Judd Co. $1.00
Diseases of Poultry. Salmon. New York: Orange Judd Co. $0.50

Farm Buildings and Appliances

Barn Plans and Outbuildings. New York: Orange Judd Co. $1.00
The Farmstead. Roberts. (See under Agriculture.)
Fences, Gates and Bridges. Compiled. New York: Orange Judd Co. $0.50
Homes for Home Builders. King. New York: Orange Judd Co. $1.00
Farm Conveniences. Compiled. New York: Orange Judd Co. $1.00
Farm Appliances. Compiled. New York: Orange Judd Co. $0.50
How to Drain a House. Waring. Boston: Osgood & Co. $1.00
The House Comfortable. Ormsbee. New York: Harper. 1.00

Rural Economy

The State and the Farmer. Bailey. New York: Macmillan. $1.25
How to Cooperate. Myrick. New York: Orange Judd Co. $1.50
Agricultural Economics. Taylor. New York: Macmillan. $1.25
Rural Wealth and Welfare. Fairchild. New York: Macmillan. $1.25
Farmers' Business Handbook. Roberts. New York: Macmillan $1.25
Book Keeping for Farmers. Atkeson. New York: Orange Judd Co. $0.25

Domestic Economy

The House Comfortable. Ormsby. (See under Farm Buildings.)
Home Sanitation. Richards and Talbot. Boston: Dana, Estes & Co. $0.25
Practical, Sanitary and Economic Cooking. Abel. New York: Orange Judd Co. $0.40
Food and Its Functions. Knight. New York: Scribner. $1.00

Science of Nutrition. Atkinson. Springfield, Mass.: C. W. Bryan.	$1.00
Easiest Ways in Housekeeping and Cooking. Campbell. Boston: Roberts Bros.	$1.00
Chemistry of Cooking and Cleaning. Richards & Elliott. Boston: Dana, Estes & Co.	$1.00
Dust and Its Dangers. Prudden. New York: Putnam.	$0.75
Canning and Preserving. Rorer. Philadelphia: Arnold & Co.	$0.40

American Association of Farmers' Institute Workers

Farmers' institute conductors D. P. Witter and Jared Van Wagenen, Jr., delivered reports of the thirteenth annual meeting of the American Association of Farmers' Institute Workers held in Washington, D. C., November 16 and 17, 1908. They were appointed delegates from New York State by the Commissioner of Agriculture. The topics presented which they discussed and which are fully covered in the report of the national meeting are as follows:

The object and special field of the Farmers' Institute.

Women's institutes: Number, methods and subjects to be treated.

The relation of the State College of Agriculture and Experiment Station to the Farmers' Institute.

Agricultural trains.

School gardens, corn judging contests and allied methods of interesting children in farm affairs.

Agriculture in the common schools.

Relation of the Farmers' Institute to the public school.

Cooperation with other educational agencies.

Boys' and girls' institutes.

Requisites of a successful farmers' institute lecturer.

Benefits of advance agents, the use of charts, lanterns, etc.

The Farmers' Institute and the agricultural fair.

Movable schools of agriculture.

State Schools of Agriculture

THE SCHOOL OF AGRICULTURE AT ST. LAWRENCE UNIVERSITY

By H. E. Cook

Dean of the New York State School of Agriculture, Canton, N. Y.

Our work at Canton concerns a new movement on the part of the State. It has been projected into the State, as you all know, and, in my opinion, it will take the very best judgment and the very best thought, not only on the part of those who are immediately associated in the work, but on the part of the agricultural forces in the State to carry out this scheme. In the case of the Canton school we have no official connection with any State institution; neither the Commissioner of Agriculture, the Director of the State Experiment Station, nor the Dean of the State College of Agriculture is one of the trustees. In a way this is unfortunate as it leaves the entire control to the judgment of men without administrative experience. However, we are going to do the best we can. The State should develop existing agricultural schools before others are founded. At present there is nothing more popular than agricultural education; it is on the lips of everyone. Men are going to look back on the fact that in the Legislature the movement has so far been political. There are other good men in the Legislature that have been doing legislative work of greater or less magnitude in the State, aside from the men who are actually responsible for these institutions already built. Unless we stand together and stand solidly back of the men who see things as we do, we shall have the State of New York covered with agricultural schools and no money to back them up and maintain them as they should be.

I feel that the State ought to have four such schools. The geographical distribution has been made rather by accident than by design, and I believe we ought to have another, located in the Hudson River Valley, and no more. It seems to me that eventually these institutions will work out a secondary relationship to our college at Cornell. We have fifty students at Canton this winter and only two of them would have taken the course at Cornell; forty-eight of them are simply there because the school is there. Naturally an institution will draw its students from those places nearest it; half of our students are from St. Lawrence, Jefferson, Franklin and Lewis counties. Our maintenance fund of $17,500, allowed by law, will not do the work that is outlined. We will have to cut somewhere.

DISCUSSION

Question.— Would you advise New York State to stand for another school before this problem is worked out?

Dean Cook.— As a matter of policy and expediency, yes. Because the State would then be well covered and well cared for.

Question.— You think it would be an economic move for the State to build another school and stop there?

Dean Cook.— It is a question between policy and economy. I would not build any more in the part of the State already covered, but think that the Hudson River Valley ought to have one.

Mr. Stevens.— Would it not be well to have colleges and schools of this character fitted up in different sections of the State for the purpose of studying the agriculture, etc., in that particular location?

Dean Cook.— If you begin to divide and subdivide so that the fruit growers have one school, and dairymen another school, grape growers another one, and so on, we will have to buy a state to build schools in. I believe every man should have his own interest at heart, and also the great interest of the State.

Question.— You mean, then, that this is not properly developed and the State is wrong to put money in it; that these schools as they are now will not solve the question?

Dean Cook.— The State ought to build these as fast as we can make good.

Mr. Ward.— Is it not safer with the present sentiment to stand together against any further development, even in southeastern New York, and risk the trouble that may come from two or three wrongs in western New York if, in your judgment, there is room for one more in eastern New York?

Dean Cook.— In northern New York our horticultural interest is very small and I do not believe that our institution should lay unusual stress upon horticulture. At the same time, I saw recently as fine apples grown in the St. Lawrence Valley as can be grown anywhere in the State, and they were sold at $5 per barrel. We should make crop growing and dairying our objective points of development, but we should not ignore the question of horticulture. I think this idea should prevail in the schools of this kind when they are built. The locality which they are supposed to serve should have their larger interests well defended. Personally, I do not think that these schools of agriculture will be able, eventually, to meet the full demand for farm training. They will, however, have a place of their own, and probably after they are filled the present high-school methods will be eliminated and county high schools will take the place of much of the work which we are now doing. I expect to see Cornell University eliminate its short-course work; I expect to see these secondary schools take up the work which they drop; then, with the county high school supported not by the State, but by the county itself, we shall have a general type of schools fully meeting our wants, outside of the work which will be developing and is now gradually being developed in the rural schools. Our boys are doing finely. The course of study includes animal husbandry, soils, farm engineering, agronomy and those academic subjects directly related to country life and business. We have been obliged to cut out our short course of three months and make it a part of the regular work, because of the lack of equipment and men. The domestic science department is a very important branch of our work, and has at present as many students as our agricultural course, proper. We have a farm, practically out of commission, which we shall develop to the best of our ability. The agricultural institutions and interests in our part of the State appear to be very loyal to our school. I trust as you pass through that section, you will advise me whether or not you find this loyalty which I mention.

Question.— When your buildings are completed, how many students shall you be able to accommodate?

Dean Cook.— It would seem about 200, although the laboratory accommodations might fail for that number. The Legislature at the last session appropriated $30,000 for a dairy building, which will relieve the main building. I am sorry to say that the plans and specifications from the state architect's office are so elaborate that they will have to be redrawn. The cost as planned by the state architect would be $40,000.

Mr. Van Wagenen.— Are not the colleges laying out too elaborate equipments? Should a beautiful structure be built such as might be found on a country estate?

Dean Cook.— I believe in the construction of a barn building for the school that will have in it certain qualities that can be copied by the farmer. To build a barn at Canton such as I would build on my own farm, in my opinion, would be wrong. It should correspond to the dignity of state construction. We ought to have a barn so constructed that a farmer can go there and pick out certain things that he can copy and use.

Question.— How much do you think such schools should have invested in a barn?

Dean Cook.— A building suitable for a school of that character should be built for $12,000 or $15,000.

Question.— Shall you include a small sterilizing plant or steam plant with equipment for sterilizing purposes?

Dean Cook.— No, I do not think we shall because of a lack of funds.

The School of Agriculture at Alfred University

By Dr. Boothe C. Davis

President of Alfred University, Alfred, N. Y.

I appreciate the courtesy which has been shown me by the Department of Agriculture in inviting me to be present at this meeting or send a representative of the State School of Agriculture at Alfred. I regret that a previous engagement makes it impossible for Director Morgan to be here.

I was pleased with all that Dean Cook said this morning, particularly with his statement that we ought all to unite against the further establishment of agricultural schools, until the articulation with the State College of Agriculture of those now established and our educational needs are better defined than now. I think his view is wise. I have had much interest in the agricultural question for the past half-dozen years. Some of the gentlemen here to-day, who have been at Alfred, will recall the fact that for four years before the Canton school was established we had a class in agriculture at Alfred University, taught by a graduate of the Massachusetts Agricultural College. We discovered, however, that it was impracticable to continue the work with so limited an equipment for agricultural instruction as we then possessed, and this led to the effort to secure the cooperation of the State in the work.

The State school at Alfred is too new to be yet fully organized or to even outline a perfected program. A careful study of secondary agricultural schools and of the needs of western New York has led us to adopt tentatively a plan somewhat resembling that of the Minnesota Agricultural School at St. Anthony Park. It is believed that students should be admitted to the school when prepared for the high school, or when they have finished the course offered in the average district school. They should be at least fourteen years of age and, if possible, should have some practical experience on a farm before entering the school.

The course, we think, should consist of three school years, shorter, perhaps, than the regular school year, with the requirement in addition for graduation of one summer term. An optional post-graduate year should be offered to fit for college, in case the student wishes to go on to the State College of Agriculture. In this way the majority of the boys and girls who come to this school will be graduated before they would be from the village high school.

Those who are familiar with Allegany county and the territory of the State surrounding us will appreciate that we have a serious problem in making it profitable for farmers to stay on the farms. They do not encourage their boys to stay on the farm as a rule. We have many hundreds and thousands of acres in that district abandoned as homes. We have been feeling for many years that this section of New York State should have enthusiastic teaching and training for boys and girls in scientific agriculture and in the appreciation of their homes; they should be taught that the economic advantages of the farm can and should be increased, that pleasure and profit in agriculture are possible. We hope to meet this need.

The Commissioner of Agriculture, the director of the State College of Agriculture and the master of the State Grange are ex officio members of the board of directors of the School of Agriculture at Alfred. It is the expectation and purpose of the school to articulate with the State College of Agriculture so that students may be prepared, in part at least, for further work in that institution. The plan which Dean Cook suggested this morning, viz., the unification of the whole system of agricultural education so as to most help those who are to go back to the farm from the school, is a problem which is to be worked out in the State in a truly pedagogic fashion. This is the problem which we are struggling to work out. We are hoping to have, with the beginning of next year, a faculty of five members, and to open the doors of the school to applicants who had to be turned away this year. Mr. O. S. Morgan, of Cornell, has been appointed director of the school. He is organizing the school, going into the neighboring communities, attending grange meetings and doing much to help the work along. A few students are on the farm doing the work of the farm. One of the young men is giving attention particularly to the production and sale of milk from the farm. Various parts of the work are assigned to different boys, thus giving them practical experience. We will increase this practical work as we get additional barns and other buildings and farm equipment. There are many things that we have learned in the past year in working out these plans, and in a few more years we shall know more than we know to-day in regard to this particular line of secondary agricultural work which is now so new in the State of New York.

There is a demand all over the country for the injection into the district school of some little elementary training in agriculture. There is absolutely a dearth of teachers for that kind of work. The teachers of the district schools have had no opportunity to become trained for such teaching; they have had no opportunity to have an interest enkindled in that work. We propose to establish a school, possibly two months in length during the summer, and try to induce the teachers of the public schools to come there. With tuition free and with opportunities to live inexpensively, we hope to train these teachers in the elementary principles of agriculture and to inspire in them an interest to teach these same subjects in district schools of western New York.

DISCUSSION

Mr. Stevens.— In taking these students from the district schools and putting them in that course, do they not need some scholastic work?

Dr. Davis.— There must be some culture subjects taught. English, chemistry, entomology, botany and geology will be taught from an elementary and economic point of view. They will get enough culture elements in the three years to enable them to appreciate intelligently the scientific work done in the State College of Agriculture and the State and National experiment stations.

Mr. Smith.— You spoke of putting four students out in the management of the farm.

Dr. Davis.— They are not in the management of the farm. They are simply doing practical work on the farm under the direction of the superintendent, and they have an opportunity for doing everything that is to be done on a well managed farm.

Mr. Ward.— Are you planning to require them to do the actual work on the farm?

Dr. Davis.— Yes, to some extent, but we are not sure just how far that can be done successfully. We do not compel them to do extended work, but we remunerate them by the hour for labor rendered.

Mr. Van Buren.— Is not the age of fourteen years rather young?

Dr. Davis.— Yes, that is the minimum age.

Question.— Will you train them to meet the entrance requirements at Cornell as they are now, or will Cornell change the entrance requirements at the College of Agriculture to accommodate the graduates of your school?

Dr. Davis.— We are hoping that they will change the entrance requirements and also the course at the Cornell College of Agriculture, in order to adapt them to the graduates of the secondary schools of agriculture.

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